General and Local Anesthesia...

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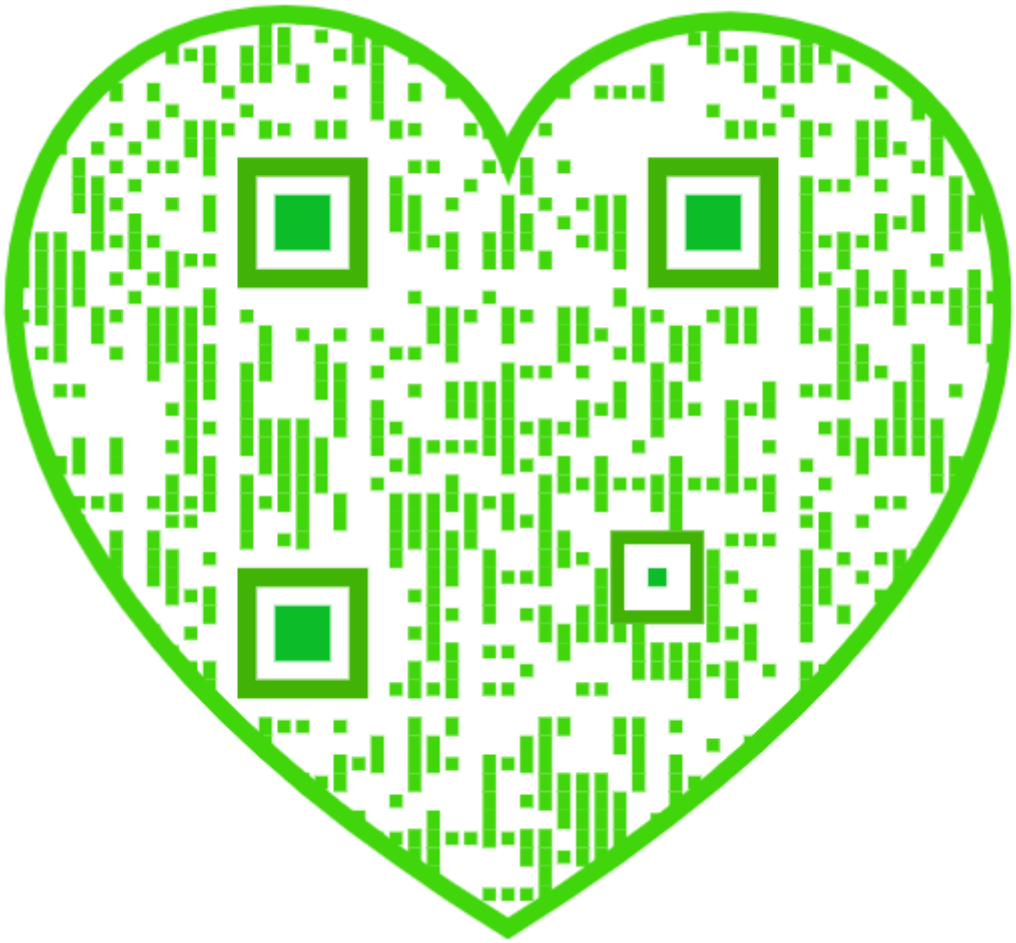

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GENERAL AND LOCAL ANESTHESIA.....

By AIMÉ PAUL HEINECK, M. D.

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"The medical man cannot acquire more than a mere rudimentary knowledge of anesthetizing from any book, but he may obtain undoubted service therefrom, enabling him to appreciate the dangers incident to, the caution necessary in anesthetizing and grasp the rationale of the various methods of procedure in the administration of anesthetics."—Dudley Buxton.

SECOND EDITION, REVISED AND ENLARGED.

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PREFACE.

The competent anesthetist is the surgeon's most valuable assistant. Conscious of this fact, I have endeavored to present in a concise form, the technique of surgical general and local anesthesia. The book could have been made more academical, could have been made to include interesting discussions of as yet unsettled points, but as it was intended for the hospital interne and for the general practitioner I decided to make it purely practical. Points that admit of controversy I have omitted. The methods that I have outlined are methods that are sanctioned by European and American clinicians. They are methods which I have tested in my surgical service at the Cook County Hospital.

The induction of anesthesia by sub-arachnoidean injections of cocaine solutions is not considered in this edition. The procedure is still in the experimental stage. Before it can be adopted by the general profession, its shortcomings will have to be remedied. Its great disadvantage is its unreliableness.

In this edition I present a large amount of new matter concerning bromide of ethyl as an anesthetic and discuss a number of important reme-

dies used for local anesthesia which were not considered in the first edition. The whole book has been rewritten and brought up to date.

I take this opportunity of thanking the attendants of the medical department of the Newberry Library for the many courtesies which they have extended to me.

Aime Paul Heineck.

April 20, 1901.

THIS MONOGRAPH

Is dedicated to

Dr. Chauncey W. Courtwright,

As a token of gratude and esteem.

CHAPTER I.

GENERAL ANESTHESIA.

Ether and chloroform are the most serviceable and the most widely used agents for the induction of general surgical anesthesia. General surgical anesthesia has its dangers. No powerful general anesthetic agent is free from risk. There is always danger in the use of a general anesthetic, whatever may be the indications for its use. Ether and chloroform are highly toxic substances, the inhalation of which is capable of producing death. All anesthetics are to be used cautiously. The mortality, however, that attends the use of these substances is largely the mortality of carelessness and of incompetency. It can be greatly reduced by observing modern safeguards and by employing improved methods of administration. The anesthetist must not depend upon a single danger-signal. He must know them all and have a clear understanding of their relative importance. When death occurs from the administration of an anesthetic, very frequently it is due to lack of watchfulness, to ignorance, and had proper precautions been taken, it would not have taken place. Statistics prove conclusively that the element of danger with either chloroform, ether or bromide of ethyl is not large provided the anesthetist be competent.

Upon the usefulness of general surgical anesthesia all are agreed. Its advantages to the surgeon are thus summarized by Dr. D. W. Cheever: "He need not hurry; he need not worry; he need not sympathize; he can calmly dissect, heedful only that the anesthetist is competent, the operation not prolonged beyond the verge of exhaustion; he can do better work; he can pause and consider; he can choose his steps; he can be deliberate, if not dextrous." In many cases there is infinitely greater danger from an unskilled anesthetist than from a bungling surgeon.

For the surgeon to derive all the forenamed advantages from the use of anesthetics, the anesthetist must be competent. He, the anesthetist, must know the physiological action of the agent which he is administering. He must be cautious and he must be vigilant in its administration. He must know the danger signals of surgical anesthesia. He must also know all the procedures by the aid of which the grave accidents of anesthesia can be forestalled and combated.

As the success and progress of surgery depend in a large measure upon the safety of anesthesia, it is evident that too much study can not be given to this subject. An operation may be practically devoid of danger, while an anesthetic is never administered without imperiling the life of the patient. Though much has been written on this

subject, though the subject is old, Dr. McBurney speaks truly when he says: "Very few medical men administer ether well." As to chloroform, many physicians, conscious that they do not know how to administer it, and not possessing the necessary ambition and energy to acquire the knowledge, never make use of it. Many that use it, use it faultily. Lord Lister says: "Death from chloroform is almost always due to faulty administration." It is easy to become a competent anesthetist, and it is the duty of every medical practitioner to become one. Anesthetics being used in all the different departments of medicine, it is imperative that all physicians should know how to skilfully administer ether and chloroform.

Knowledge is only acquired by observation and by study. To become a good anesthetist, one must be taught, and must learn, how to induce and how to maintain surgical anesthesia. Theoretical and practical knowledge are both required. The value of theoretical knowledge lies greatly in the fact that more attention is paid to useful practical details, if the philosophy underlying their utility is evident or is known.

The giving of an anesthetic should never be delegated to a nurse, much less to a layman. Nurses, owing to their incomplete medical education, of necessity, are irresponsible anesthetists. They should not undertake and should not be

asked to discharge the duties of a medical practitioner. The giving of an anesthetic requires the undivided attention of an educated and watchful physician. It requires accurate knowledge. It demands the closest application. The surgeon must not "start the anesthetic" and then entrust the continuance and the maintenance of the anesthesia to an unqualified bystander. Accidents occur during all the different stages of anesthesia, and must be immediately met by appropriate measures, so as not to prove fatal.

Never should the surgeon administer chloroform or ether, and operate at the same time. It is false economy. There is no scarcity of physicians. It is unsafe. Deaths have been caused by this practice. By attempting to do two things at once, the surgeon does neither well. The anesthetic is not watched as it should be watched. The anesthetist's eye should never be off his patient during the entire duration of the anesthesia. Asepsis, of necessity, will be deficient. The neglect of aseptic teachings invites suppuration with its train of annoyances. His mind will not be concentrated upon the technique of the operation, hence the surgical methods employed will be at fault and results will not be ideal.

An anesthetic should not be given if the patient refuses to be anesthetized. Should the patient's mental condition be such as to unfit him for pass-

ing on the advisability of anesthesia, the consent of his relations or his friends must be obtained. In emergency cases if the patient be unconscious and in the absence of friends and relatives, the surgeon may take the responsibility of administering the anesthetic.

Indications for the use of ether or chloroform anesthesia are:

1. For Diagnostic Purposes: (a) In complete exploration of rectum, or genitourinary organs; (b) in children, in exploring the bladder for stone, since in children the bladder is so sensitive that it empties itself when an instrument is introduced; (c) in obscure abdominal and pelvic conditions, a precise diagnosis not being otherwise obtainable, as in carcinoma ventriculi, as in gynecological conditions, such as pus-tubes, etc. "Examinations under anesthesia can be conducted with a thoroughness which is impossible without it; the uterus can be drawn down, adhesions pulled upon, perineum deeply invaginated and inflamed tubes and ovaries handled in a way which is impossible so long as the patient remains conscious" (Kelly, Baltimore); (d) it may be used to exclude hysterical conditions—hysterical joint, pseudocyesis, etc.; (e) to exclude simulation.

Rotterstein reports the case of a military officer who simulated aphonia, so as to secure his discharge from the army. While being anesthetized,

in the stage of excitement, he began to sing. He was not discharged from the army. (f) In many cases, it is only by means of narcosis that we can obtain a sufficiently satisfactory view of the eyes. In blepharospasm, especially in children, by proceeding with violence, there is danger of abrading the eyeballs. This is especially to be feared in purulent ophthalmia and in corneal ulceration. In adults, cocaine anesthesia is often sufficient. Anesthesia is of value as an aid to diagnosis, because by it insensibility to pain on the part of the patient is secured, and through it, also, complete muscular relaxation is obtained. Complete muscular relaxation is especially valuable in the diagnosing of fractures and of abdominal and pelvic pathological conditions. Examinations under it can therefore be more prolonged, more deliberate, more accurate. All resistance, voluntary and involuntary, on part of the patient is done away with.

2. For Therapeutic Purposes: In spasm, convulsions (epilepsy, puerperal eclampsia, tetanus), very painful neuralgias (tic douloureux, visceralgia of neurasthenia), renal colic, hepatic colic, intestinal colic. Tournier (Belfort) employs etherization in the treatment of hysteric and hysteroepileptic convulsions occurring in children and in adults.

The anesthesia is used to abort the spasms or convulsions. "In epileptic attacks, every effort should be made to lessen the liability of danger to the patient from the violence of the spasms. One is at times justified to use ether or chloroform by inhalation to control the severity of the convulsions." (Anders.) In the other conditions, we have recourse to anesthesia when the suffering is beyond the influence of safe doses of morphine. In these conditions, we only administer chloroform till relief of pain occurs.

3. IN OBSTETRICS. (A) In labor, we employ anesthetics to mitigate the suffering of natural labor, to secure a semianesthesia, that is an analgesia, a marked diminution of pain in the uterine and the periuterine regions. Winckel states that general anesthetics render great service when the cervix is almost dilated and when the presenting part begins to pass through the vulva. We use them in natural labors in primiparæ who are nervous and excitable and in whom the pain may even cause delirium; in all cases in which there is a spasmodic contraction or rigidity of the neck or body of the uterus.

The following conditions contraindicate their use: Opposition of the patient to their use; absence of severe suffering; placenta previa; alcoholism; marked disease of the circulatory or respiratory apparatus.

ANESTHETICS IN CHILDBIRTH.

The following facts as to the use of anesthetics in childbirth are established:

a. Chloroform is the agent sanctioned by almost all the authorities. It is pleasant to take. It acts quickly. Ether is disagreeable to take, is slow of action. Ethyl bromide has irritating properties, a disagreeable odor and interferes with the pains. It should not be used in obstetrics. It is not a safe anesthetic for prolonged intermittent use. Chloroform, unlike ether, is not inflammable. Hence, it can be used at night, without any danger from light or fire. And certainly it is at night that the largest number of obstetrical cases occur. When using chloroform, in a room illuminated by coal-gas, for your personal and for the patient's safety, see that the room is properly ventilated.

b. Chloroform should be administered at the beginning of each pain, and discontinued as soon as the pain has passed, then resumed at beginning of next pain, discontinued at close of pain and so on. Never should complete insensibility be obtained. The object sought in natural labor is a mitigation of the pain, a semianesthesia. Complete anesthesia would interfere with the progress of labor.

c. Anesthetics are not harmful to the child. Anesthesia of the child is not produced. They are not harmful to the mother. "Lactation is not

injuriously affected, nor is the child in any way injured." (Buxton.) The almost complete immunity enjoyed by the woman in childbirth, from the accidents of anesthesia, is partly due to the following conditions: Marked hypertrophy of the left ventricle during pregnancy; recumbent posture which patient naturally assumes during delivery; action of the heart is aided by the alternate relaxations and contractions of the uterus; the tendency of anesthetics is to produce anemia of the brain. This anemia is counteracted by the labor-pains which give rise to an engorgement of that organ. Pain is a stimulant to the vaso-motor system, and, consequently, there is less danger in anesthesia while labor-pains are in progress. (Hare.)

Anesthetics do not, provided the narcosis be not too profound, interfere with the uterine contractions. They do not interfere with the contractions of the abdominal muscles. They weaken the resistance of the perineal muscles. They are of distinct advantage to the mother because by their attenuation of pain the progress of labor is hastened [this fact is especially demonstrable in women that fear pain]; because they calm the extreme agitation and cerebral excitement that labor often produces in very nervous women, and because, by shortening labor, they lessen its traumatisms, greatly diminish the parturient's pros-

tration, and make her recovery more rapid. Cardiac, pulmonary and renal lesions are not absolute contraindications to their use in difficult labors. Ether would doubtless be less dangerous to a damaged heart, and cause less shock to the nervous and vascular systems, than would the agony of a severe extraction such as would occur with an excessively large fetal head or a small maternal pelvic outlet. (E. H. Root.)

After profound anesthesia during delivery, increased watchfulness against hemorrhage is enjoined by most teachers. Playfair believes that the use of anesthetics increases the tendency to hemorrhage. This tendency to hemorrhage is disputed by many good authorities. Fordyce Barker, of New York, says: "Through a long number of years I have rarely attended labors without ether. I have never seen from it any ill effects. Especially has it not caused a tendency to hemorrhage."

(B) In eclampsia (puerperal) to abort the convulsions.

(C) In all obstetrical operations as: Version, application of forceps and extraction by embryotomy, etc.

In all obstetrical operations the anesthesia must be complete, must be surgical, not obstetrical.

In obstetrics, if surgical, and not obstetrical

anesthesia is indicated, you will be governed in your choice of anesthetic agent by the same rules that obtain in the absence of the pregnant condition. For instance, if the patient has a cardiac lesion, use ether instead of chloroform; if there is a marked renal lesion, use chloroform and not ether.

ANESTHETICS IN SURGERY.

In all cases in which there is an indication for surgical anesthesia and the condition of the tissues or the nature of the operation do not admit of the employment of local anesthetics, we have recourse to general anesthetics. We use ether or chloroform for all operations requiring a longer and deeper anesthesia than can be obtained by nitrous oxide gas or bromide of ethyl.

There are no absolute contraindications to the induction of general surgical anesthesia. When the physical condition of the patient permits the performance of an operation, it permits of the giving of an anesthetic. The question to be decided is whether the disadvantages attending the use of the anesthetic more than counterbalance the advantages of its employment.

There are, however, unfavorable conditions. No age, no sex, no climate confers immunity from the dangers of ether and chloroform anesthesia. Pregnancy and menstruation do not contraindi-

cate ether or chloroform anesthesia. They may, however, contraindicate the operation. I have not found a single case reported in which the induction of surgical anesthesia has caused abortion.

In the following conditions the giving of an anesthetic is hazardous, because experience has taught us that patients suffering from these conditions are subject to the grave dangers and accidents of anesthesia:

In patients having severe organic lesions of the central nervous system, of the pulmonary system, of the circulatory system; in delirium tremens, the different neuroses as epilepsy, hysteria, etc.; in aneurisms of the arch of the aorta or the innominate artery, because there is danger of vascular rupture or because death frequently occurs from its administration in this condition; in surgical shock; in cachexia from any cause, fever, prolonged suppuration, suffering from intense and constant pain. "These conditions bring such changes in tissue nutrition and tissue vigor as to render the action of ether and chloroform for the time being abnormal." (Gill, St. Barthol. Hosp. Rep., London, 1895.)

SELECTION OF THE ANESTHETIC.

The following statistics, being the combined statistics of Gurtl of Berlin and of Juillard of

Geneva, show that chloroform and ether have each their mortality:

Anesthetic Used.	Adm.	Deaths.
Chloroform.....	691,319	224, or 1 in 3,082
Ether.....	341,058	23, or 1 in 14,828

Despite the unfavorable showing made in the above figures by chloroform, from the standpoint of safety as compared to ether, chloroform maintains its popularity, its advocates declaring that in competent hands it is preferable to ether, because it is less disagreeable to take, less irritating to the lungs, its stage of excitement is shorter, and its after-effects, such as nausea and vomiting, less annoying, less prolonged than those of ether. "Nausea and general depression are more pronounced after the use of ether than after the use of chloroform." (Hare.) Ether and chloroform have each their individual contraindications. Clinical experience teaches us that the mortality from anesthesia can be much diminished by the careful selection of the anesthetic in each individual case. This selection is to be arrived at by a consideration of the age of patient, of the climate, of the environments, of the physical condition of the patient, of the nature of the operation, of the posture of the patient, of his idiosyncrasies, and of the skill of the anesthetist.

This is the only scientific method of procedure. Failure to do this will at times be followed by fatal

accidents. In the absence of indications (which are to be later enumerated) for the use of chloroform, ether is the anesthetic to use. The contra-indications to the use of chloroform furnish indications for the use of ether. The following quotations from eminent experimental therapeutists and from well-known surgeons uphold this view:

"Ether is by far the safest anesthetic substance for use during prolonged surgical operations." (Hare.) "Chloroform is seven times as dangerous as ether." (Waller.) H. C. Wood urges the general use of ether, and adds: "In the selection of an anesthetic, the question of safety is paramount." "I am certain that ether is infinitely safer than chloroform." (Frederick Treves.)

AGE OF PATIENT.

In children, previous to the age of seven years, chloroform is the safest anesthetic. The relative immunity of children to chloroform narcosis is due to the great vascularity of their nervous system. The percentage of chloroform mortality in children is much below that of older patients. In children, ether causes a great outflow of bronchial mucus. This mucus can asphyxiate the patient. The bronchial mucous membrane of children is delicate and predisposed to inflammatory processes. Ether is a direct irritant to these mucous surfaces and can, and often does, excite inflammation of the air passages.

As a general rule, ether should not be administered to patients over sixty years of age, because these patients, as a class, either suffer from or are on the verge of renal and of pulmonary degenerative changes. Ether is contraindicated in renal and in pulmonary affections.

CLIMATE.

In warm climates use chloroform. It would seem that the warm atmosphere of tropical climates causes a rapid action of the chloroform and, at the same time, its rapid evaporation. Lawrie records 45,000 chloroformizations without a death. A warm climate renders chloroform vapor more diffusable and so lessens its noxious effects. The respiratory functions are not so paramount, owing to the great activity of the hepatic and cutaneous functions in warm climates. Ether is obtained and preserved with difficulty in tropical countries.

ENVIRONMENTS.

On the battlefield and in the navy, chloroform is the anesthetic to use. It is less bulky. The quantity of chloroform needed to anesthetize a patient is less voluminous than the quantity of ether required for the same purpose. Ether is inflammable, chloroform is not. It produces anesthesia in less time than ether. The amount of work to be performed being great, time is an important factor.

When the thermo-cautery is to be used about the face, use chloroform.

In operations by gaslight, use chloroform. Ether is inflammable and explosive. This fact should always be borne in mind, because, during an operation, a lighted candle or gas jet brought near the ether may cause a serious explosion. The danger of using ether near a lighted gas jet is shown by numerous news items.

PHYSICAL CONDITION OF PATIENT.

(a) In atheromatous conditions of the blood-vessels, use chloroform, because ether produces a more violent, a more prolonged stage of excitement, thereby increasing the liability to vascular rupture and its consequences. Ether increases the heart action and raises the blood pressure, and hence is liable to cause hemorrhage from weakened blood-vessels.

(b) In organic cardiac lesions, always select ether. In this connection, we must always remember that the integrity of the muscular structure of the heart is of far greater importance than the integrity of the valves. We select ether because chloroform is a powerful cardiac depressant and paralyzant; because chloroform acts upon the heart; it causes a marked depression of the cardiac muscle, involving a reduction of its tone, a relaxation of the cardiac walls, and an impairment of its

functional activity. (McWilliam, British Med. J., 1890); because ether is a cardiac stimulant; because experiments and clinical observation show that chloroform kills generally by syncope (Verneuil), and organic cardiac lesions by their very nature predispose to this accident. Sudden arrest of the heart's action, from structural disease, may take place during the first few minutes of chloroform anaesthesia; and because failure to select ether is liable to result in accidents. Should, however, the cardiac lesion be accompanied by marked bronchial or pulmonary congestion, use chloroform.

If a fluidram of ether be injected directly into the jugular vein of a dog, there is no fall in arterial pressure; if twenty drops of chloroform be injected, it will immediately cause a fatal paralysis of heart. Sphygmographic tracings show that ether exerts a stimulant action upon the heart. They also show that chloroform exerts an opposite action. A small, weak and compressible pulse grows stronger under ether.

In renal affections use chloroform, because quantity for quantity ether is, of course, less irritating to the kidneys, but as a very much larger quantity of ether than of chloroform is needed to produce anesthesia, chloroform is to be preferred. The effect of chloroform anesthesia on kidneys is practically nil. Drs. Thompson and

Kemp, who have made experimental researches upon the circulation of the kidneys, regard chronic renal disease or the pressure of any of the systemic signs of renal inadequacy, such as rigid arteries, high tension pulse and dilated right heart with chronic bronchitis, as contraindications to the use of ether, and if any general anesthetic has to be employed, advise the use of chloroform.

In an examination of fifty cases before and after etherization (urine filtered and nitric acid test used), thirty-six cases showed that ether either produced albumin or increased its quantity when it was present before. (Blake.) Ether may cause oliguria, anuria, or nephritis.

OTHER CONDITIONS.

In diabetes mellitus, use chloroform. The use of ether in diabetic patients has been followed by diabetic coma. (Hare, Da Costa.)

In inflammatory conditions of the upper and the lower respiratory organs, as rhinitis, laryngitis, tracheitis, bronchitis, pneumonia, asthma, emphysema, use chloroform, because ether is a distinct irritant to mucous membranes of the respiratory passages and because untoward effects of ether are mainly exercised upon the respiratory system. (Sajous.)

When there is a susceptibility to pulmonary inflammations, use chloroform.

In phthisis pulmonalis, use chloroform.

In collapse, especially that following the loss of blood in shock, as characterized by low temperature, in asthenia, cachexia and in anemia, use ether (but use it sparingly), because ether has stimulating properties, and because a comparatively small dose of chloroform may produce alarming or fatal cardiac depression.

In alcoholics, if the condition of the heart permits, use chloroform. Alcoholics are so steeped in stimulants that large quantities of ether must be employed to secure anesthesia, and even then may be ineffective.

When the liver function is impaired, use ether.

In obese and plethoric individuals, use chloroform. Ether, by causing marked engorgement of the upper air passages, and increased secretion of saliva and mucus, renders respiration difficult.

In goitre, and in all conditions tending to reduce the caliber of larynx, trachea or bronchi, as malignant disease of throat and neck, deep cervical cellulitis, foreign bodies in the air passages, foreign bodies in the esophagus, asthma, etc., use chloroform, if local anesthesia be unsuitable.

In empyema, chronic pleural disease, with or without marked secondary pulmonary changes, use chloroform.

In all conditions causing such narrowness of upper air passages as to produce temporary or

abiding difficulty in breathing, as tumors of soft palate, larnygeal disease, aneurism pressing on trachea, use chloroform.

Hare prefers to use ether in young athletes, for clinical experience shows that this class of patients are especially liable to accidents with chloroform.

NATURE OF OPERATION.

A. Use chloroform in prolonged operations about the mouth, nose and pharynx, when mouth and nose must frequently be uncovered, because, owing to the fact that consciousness rapidly returns when the supply of ether is discontinued, its (ether's) intermittent use does not give enough time for prolonged surgical procedure.

B. Always give chloroform when the anesthetic is to be given through a tracheal canula.

C. In ophthalmology, use chloroform. Ether, by causing struggling and venous congestion, increases the risk of hemorrhage. Its after-effects, as vomiting, etc., also disqualify its use in ophthalmic work.

D. Use chloroform for tracheotomy, if local anesthesia prove ineffective; also for esophagotomy and in laryngeal operations.

E. Use chloroform in operations in which venous engorgement constitutes a serious difficulty, as in removal of glands at root of neck; tracheotomy; operations on brain and its mem-

branes, etc.; with ether the venous system is engorged and incised parts bleed freely. (Hewitt.)

F. In cranial operations, in functional or organic diseases of the brain, use chloroform. Ether produces engorgement of the cerebral vessels, and general engorgement of the venous circulation. By using chloroform we shorten the stage of excitement and lessen the tendency to hemorrhage.

G. In abdominal operations, use chloroform. "In abdominal surgery chloroform is better than ether." (Kelly, Baltimore.) Respiration is much quieter under chloroform than under ether. Engorgement of part is considerably less, hence less hemorrhage. Muscular relaxation is more complete. Relaxation of the abdominal parietes is very important in abdominal operations. In some cases, ether fails to secure this. The tendency of patient to cough and strain is considerably less after chloroform than after ether. Chloroform is less frequently followed by vomiting. Ether increases the bronchial secretions. The stagnation of these in the bronchi can excite pathological conditions. After abdominal operation, the expelling power by which the bronchi are emptied is lessened, owing to the inhibition by pain and by the incision of the abdominal muscles. Chloroform does not increase the bronchial secretions, and hence is comparatively free from bronchial or pulmonary after-effects.

H. Chloroform is used in obstetrics, and in hepatic and renal colic. Its action is quick. It is less disagreeable to take.

I. In operating upon the neck, use chloroform. There is less movement of the parts. Ether, by provoking copious salivary and bronchial secretions, hampers respiration and renders it jerky.

J. Chloroform should never be used for extracting teeth. Nitrous-oxide gas is a safe and convenient anesthetic, and fulfills, with very few exceptions, all the requirements of the dentist. In Lyman's collection of deaths from chloroform anesthesia (393 in number) there are thirty deaths that occurred under chloroform anesthesia induced for removal of teeth.

K. Chloroform should not be used for minor operations, such as removal of ingrowing toe-nail, opening of superficial abscess, or when local anesthesia fulfills the requirements. "A very large proportion of deaths from chloroform anesthesia have occurred with minor operations." (Hewitt.)

L. In the operation for removal of naso-pharyngeal adenoids, use ether, if local anesthesia is unsuitable, or if you do not wish to use bromide of ethyl anesthesia. This operation is not so very painful. I have frequently seen Prof. Coulter perform it without previously anesthetizing the parts or the patient, and it did not seem to provoke very great suffering. I have myself operated on mild

cases without an anesthetic. Hinckel has collected eighteen cases of death under chloroform in this operation as occurring within the last five years. During this same period, there was only one case of death from ether administered for throat operation. This operation was a tonsilotomy. Dr. Paltauf says: "As a result of enlargement of the thymus gland, and other lymphoid structures, there is a particular predisposition of the individual to cardiac syncope." Syncope is a common mode of death under chloroform anesthesia. Brickner says: "In anesthetizing patients of the lymphatic temperament, or in whom lymphatic enlargements or adenoid vegetations exist, choloroform should be rigidly interdicted." The posture usually given to the patient in this operation, a sitting or semi-recumbent one, renders the use of chloroform inadmissible. For the removal of nasopharyngeal adenoids, Coulter, Hawley and many other laryngologists make use of bromide of ethyl anesthesia.

M. In rectal surgery give ether. Allingham believes ether to be the safer anesthetic in rectal surgery. Deep narcosis is here required. The rectal reflex is a late reflex to depart. Deep ether narcosis is less dangerous than deep chloroform narcosis. The anal reflex is one of the last reflexes to be abolished. Its abolition requires profound anesthesia. When this reflex is absent, no resist-

ance is offered to finger or instrument entering the rectum.

POSTURE OF PATIENT.

Chloroform is the safest anesthetic for laparotomy in Trendelenburg's posture. (Garrigues, Cleveland, Goodell, Sutton.) This position tends to produce congestion of brain. Ether has this same property. Both causes combined may cause rupture of cerebral vessels.

Any operation that must be performed in the upright, sitting or semirecumbent posture, forbids the use of chloroform anesthesia. As to the knee-chest posture, it is not a position for anesthesia.

In the prone posture, give ether. In this position the face, the eyeballs, the pupils are more or less concealed from observation, the pulse is not as easily watched as in the dorsal position, therefore the respirations are our main guide as to the condition of the patient. The breathing under ether is strong and audible, hence the value of ether when this posture must be maintained during the course of the operation.

If in a previous anesthesia, the patient has taken ether very poorly, the selection of chloroform is proper. The same also applies to chloroform. When in the course of chloroform anesthesia, such evidences of chloroform intoxication as blanching of face, great rapidity of pulse (120-140), sudden dilatation of the pupils, become apparent, if the

anesthesia is to be continued, you will continue it with the use of ether.

If the anesthetist is inexperienced, ether is the anesthetic to be chosen. The safety margin is much less with chloroform than with ether. Ether kills slowly, gives plenty of warning. Chloroform gives no warning whatever, and kills quickly.

Use chloroform in emergency cases, where great speed is required.

PREPARATION OF PATIENT.

Prepare the patient carefully; the minutest details to secure the best conditions should never be regarded as too insignificant.

1. Ascertain condition of heart, lungs and kidneys of patient. It will guide you in your selection of the anesthetic agent. Knowing the physical condition of your patient, you will be on the alert for possible accidents, and be better prepared to meet them. By carefully preparing your patient for the ordeal of anesthesia, you greatly minimize the dangers incident to this condition. "It is far better to err on the side of an unnecessarily cautious investigation than to overlook symptoms which if recognized would be of service in conducting the administration of the anesthetic." (Wm. S. Deutsch.) An existing bronchitis should be palliated or cured. If the operation is one of a certain duration, and the examination of the urine reveals the presence of albumin and casts, place

patient on a milk diet for a few days previous to the operation. Especially is this indicated if the daily passage of urine is much below the normal. In this connection remember that water is our best diuretic.

2. Toilet of naso-pharyngeal passages. Cleansing of naso-pharyngeal mucosa by the use of an alkaline solution. This removes the secretions, thereby permitting much easier breathing and increasing the facility with which anesthesia can be induced and maintained. Ether promotes separation of foreign substances from naso-pharynx. The aspiration of these irritating morbid products (dessicated secretions), with their lurking micro-organisms, from the higher to the lower respiratory passages, can set up bronchial or pulmonary inflammation. An existing rhinitis should be palliated or cured. If a nasal obstruction to free breathing exists, it must be attended to.

3. Mouth wash of some efficient and pleasant antiseptic solution, as listerine or borolyptol.

4. Examine the eyes. If patient has a glass eye, remember it. Note the degree of dilatation, the regularity and the mobility of the pupils.

5. Examine joints for ankylosis. "An ankylosed elbow not previously noticed may lead you to believe the patient is not relaxed, and in your endeavor to secure complete muscular relaxation the anesthesia will be pushed too far."

6. Order a hot bath, when practicable, on the day before the operation. It assists the emunctory function of the skin.

7. Bowels should be evacuated on the night before operation by a laxative. An enema should be given on the morning, two hours before the operation. This measure lessens the nausea and vomiting. (Buxton.) Empty the bowels of feces, thereby minimizing fermentation and abdominal distention and avoiding distressing pressure on the heart and lungs. (Gallant.) "In my experience, the salines act best for this purpose, and if the liver is inactive may be preceded by small doses of calomel. The salines, particularly the magnesium sulphate, act quickly, clear out the intestinal tract thoroughly, and leave the secretions in a healthy condition. The vegetable cathartics cause more or less violent and irregular peristalsis, which keeps the patient awake, and they usually leave the intestinal tract in an irritable condition. I have frequently recognized in the dark vomited material following an afternoon operation, the compound liquorice powder taken the night before, and have observed that patients who had taken a saline did not vomit to the same extent and suffered very little from intestinal disturbances afterward." (H. W. Carter.)

8. On the night before the operation, give patient a hypnotic, so as to secure a restful night. "A good night's rest is one of the best means of

fortifying a patient against subsequent shock." (Gallant.)

9. Patient's urine to be voided on morning of the operation. In abdominal operations the patient is to be catheterized before beginning the administration of the anesthetic. A distended bladder interferes with operative procedures.

10. In women, hair should be tied in towel or cap.

11. All unnecessary clothing is to be removed and all head jewelry, such as earrings, combs, etc.

12. In cases of intestinal obstruction attended with fecal vomiting, as strangulated hernia, etc., lavage of stomach before administering the anesthetic lessens the danger of emesis during the course of the operation. The entrance of fecal vomit into the trachea causes either pneumonia or death.

13. The best time for an operation of election is early in the morning or early in the afternoon. These are the periods of greatest vitality. Late in the day, the body is fatigued. "Individuals are more liable to after-effects of an unpleasant character when their bodily condition is one of nervous exhaustion and lowered vitality." (Willard and Adler.)

14. If the operation is to be performed in the forenoon the patient should have a light supper on the day previous to the operation, and no breakfast

on the day of the operation. If the operation is to be performed in the afternoon the patient should have a light breakfast and no dinner on the day of the operation.

15. If the patient is very weak, for a few days previous to the operation he should be put upon tonic medication.

RULES FOR BOTH ETHER AND CHLOROFORM.

1. The temperature of the room in which ether or chloroform are to be used should not be below 70 deg. F.; when the trachea or abdomen are to be opened not below 85 deg. F. Room should be free from draughts to avoid chilling of the body.

2. The anesthetist should be provided with a clean apron and clean towels; pledgets of gauze (plain); Allis inhaler; Esmarch inhaler; two long artery forceps, to serve as gauze-sponge holders; mouth-gag; tongue forceps; hypodermic syringes—one with strych. sulph., gr. 1-20, the other with tr. digitalis, m x-xx; cosmoline or other bland fatty substance; rubber catheters; tracheal canula. Strychnine, digitalis and ammonia are the most serviceable drugs in the accidents of anesthesia. Nitrite of amyl, caffeine and atropine are of little or no use in chloroform poisoning. (H. C. Wood.) Restorative agents should be close at hand, so that in case of impending danger relief can be immediate.

3. Anesthetics must not be self-administered. Up to 1880, there were 20 deaths on record from the self-administration of chloroform. (Lyman.)

4. Before beginning to give the anesthetic, scrub your hands with soap and water and put on a clean apron. It is cleanly. It makes a good impression.

5. Always clean cone or mask, sterilization is preferable, before each anesthesia. This will promote the comfort of patient, cleanliness and non-conveyance of infection.

6. Always satisfy yourself of the purity of the drug that you are going to administer. Enydahl attributes his great success with anesthesia to the absolute purity of the ether which he uses. "Impure chloroform is very dangerous to life." (Hare.) Perrin cites fatalities due to impure chloroform. The impurities of chloroform, such as chlorine and hydrochloric acid, lengthen and intensify the stage of excitement, aggravate the irritating action of chloroform upon mucous membranes, and increase the liability to sickness during and after anesthesia. They are said to favor the production of cardiac and respiratory syncope. Tasse says, "Impure chloroform is capable of poisoning the nervous system, producing paralysis, and transient or permanent albuminuria." The purity of ether may be tested by adding to it a small amount of oil of copaiba. Clearness of solution indicates purity

of ether; any cloudiness or emulsion indicates impurities. Ether readily develops impurities. It should not be exposed to light. The can should be kept closed. To ascertain the purity of chloroform, dip chemically pure filter paper into chloroform, and allow the latter to evaporate. Pure chloroform leaves no odor. If the chloroform tested is impure, a more or less irritating, unpleasant smell remains. Chloroform should be kept in glass-stoppered, dark-colored bottles. The addition to chloroform of a small quantity of ethylic alcohol 1-1000, prevents its decomposition.

7. Win the patients' confidence, reassure them as to the outcome of the operation; tell them that there is no cause for alarm, that anesthesia has no dangers. The heart can be made functionally incompetent by fright. "The element of fear can easily lead to heart failure." (Richardson.) A fatal result taking place within a few minutes after the commencement of the inhalation of the anesthetic can be caused by syncope, the effect of fear. Anxiety and fear are heart depressants, and may produce dangerous, and even fatal, symptoms. Examples: Desault was about to perform a lithotomy; to demonstrate the line of incision, he drew his finger-nail over the patient's perineum. The patient uttered a loud cry and suddenly died. Cazenave was about to operate on a very nervous patient. He did not give chloroform, but made a

pretense by putting a towel over patient's nose. The respiration and heart stopped. The patient was dead.

8. Always give the anesthetic upon an empty stomach. The patient should not, however, be kept too long without food. If the patient is too long without food, bile is apt to flow into the stomach and induce vomiting during anesthesia. Five to six hours should have elapsed since food was last taken. By taking this precaution the tendency to vomiting is lessened. "Vomiting is almost a constant sequel in those who have inhaled the drug upon a full stomach." (Hare.) A distended stomach impedes the heart's action. In operations upon the stomach or intestines, Dr. McBurney washes out stomach previous to anesthetizing patient. Vomiting is annoying to the anesthetist; it retards the production of anesthesia; it can produce harm by disturbing the relation of wound flaps, by giving rise to hemorrhage from cut vessels imperfectly blocked, by disturbing and soiling dressings. In abdominal operations, it causes a protrusion of intestines; aspiration of vomited matter can cause: aspiration pneumonia and asphyxia; vomited matter may lodge in the esophagus, and from there compress trachea and cause asphyxia.

9. The anesthetist should be behind the patient's head, or at side of head. He should have a

knowledge of the different steps of the operation that is to be performed and of the length of time that will be required to perform it. For example, in an operation on hemorrhoids while the sphincter is being dilated the anesthetist should remove the cone or mask from the patient's face. Stretching of the sphincter excites deep inspiration and if the cone is not removed the patient may inhale an overdose of the anesthetic. In an operation on a cleft palate he must know when to intermit and when to resume the administration of the anesthetic. Previous to the cutting of important nerves by the operator he must be sure that his anesthesia is complete.

10. Always, when the nature of the operation allows it (and there are very few operations that do not), anesthetize the patient in the recumbent posture. The giving of chloroform to a patient in the sitting posture is an unjustifiable error. The Hyderabad commission insists that chloroform be given in the recumbent position. The recumbent posture is to be selected because it facilitates the circulation between the heart and the brain, thereby lessening the tendency to syncope. Failure of respiration in chloroform narcosis is due to anemia of the respiratory center. The horizontal posture does not favor this anemia; the sitting posture does. This position is also the position of election for ether anesthesia. "Dentists who

administer ether to their patients in an erect posture have more deaths during anesthesia, proportionately, than surgeons who administer to patients in the recumbent posture." (Hare.)

Force of gravity has a marked influence upon the circulation. The sitting and vertical postures cause a fall of blood pressure in the carotid arteries, the horizontal posture restores the blood-pressure in these vessels to its normal state. Chloroform lowers the blood pressure by its depressing action on the vaso-motor apparatus, and on the heart and its contained ganglia. The upright, sitting and semirecumbent postures lower the blood pressure in the cranial and cervical vessels. Chloroform and faulty position acting together produce an anaemia of the medulla oblongata. From this anaemia, if it be sufficiently marked, results syncope.

The splanchnic vaso-motor mechanism controls the abdominal vascular area. Chloroform paralyzes this mechanism. This paralysis allows dilatation of the abdominal veins, and in the sitting and similar postures, the force of gravity aiding, the blood drains into these veins, the right heart is emptied and the cerebral circulation fails.

It is the most convenient position for the anesthetist. It gives him a better view of the face, of the pupils, of the respiratory movements of the patient and enables him to easily palpate the facial

or temporal artery. These arteries keep him informed of the patient's heart action. In this position he can easily prevent tongue from falling backward by pressing and keeping forward, with little and ring finger, the rami of the jaw. He can easily feel the expiratory current of air, by putting thumb occasionally over the patient's mouth, thereby ascertaining that the patient is breathing. This is important because the epigastric region may rise and fall, and still no air enter the lungs. He can easily hear the respiratory murmur. He can better watch action of the diaphragm.

The position admits of better expansion of chest. For the safe administration of chloroform and ether, expiration must not be impeded. This condition is only obtained in positions that permit the lungs to expand and contract freely. To secure this full expansion and contraction of the lungs, in addition to suitable position, the air passages must be straightened out, the glottis must be free, and the tongue prevented from falling back. The side position impedes respiration, and especially is this marked when a pleural effusion is present. When the heart's action is interfered with, by old adhesions, by tumors, etc., the side position greatly increases the tendency to heart-failure or syncope.

The prone position hampers respiration, (a) by preventing free expansion of chest, (b) by preventing descent of diaphragm, owing to the pressure

exerted in this position on abdominal wall and viscera. "Knee-chest posture must never be used in anesthesia." (Hewitt.) In obstetrics, semi-lateral position can be used. "It is said that during gynecological and obstetric operations, in which the patients are kept lying on the left side, the pulse and respiration have been more satisfactory during anesthesia from chloroform than when patients have taken it in the dorsal position. It may be that the view which attributes special safety to the drug in obstetrical cases took its origin in the fact that the customary obstetrical position in England and in this country is upon the left side. Buxton thinks that the influence of position is unquestionably important, and is due to the fact that the condition of the heart, lungs, tongue and larynx is more nearly correct physically and physiologically when the patient is placed in the left lateral position instead of on the back." (Am. Text-Book of Surgery.)

In laryngeal and abdominal operations the Trendelenburg position is very satisfactory. The anesthesia, however, must be started in recumbent posture, and when patient is under the anesthetic, position is changed. If in the Trendelenburg position, the cyanosis of face becomes marked, patient must temporarily be returned to horizontal position.

In operations upon naso-pharyngeal adenoids, if

the operator insists upon sitting posture, begin administering the anesthetic in the recumbent position, then, once patient is anesthetized, slowly raise him to sitting posture and have head and shoulders well thrown forward. (Hewitt.) This position is favorable for the escape of blood. Never use chloroform in this position. Henry Davis, in the British Med. Journal, for the removal of naso-pharyngeal adenoids, advises having patient on back, with head drawn over the table, as in the method now so frequently employed for staphylorrhaphy. He says that in this position blood cannot trickle downward in the larynx, but that it collects in the roof of the pharnyx, which in this position forms, as it were, a cup from which the blood and fragments of adenoid tissue can be easily removed.

PRECAUTIONS BEFORE AND DURING ANESTHESIA.

11. In operations upon throat, elevate shoulders and keep head pendent so that blood will not gravitate into the trachea.

12. Always have patient's mouth free from false teeth, chewing gum, or other foreign bodies, before starting to administer the anesthetic. Foreign bodies interfere with respiration. If an emergency arises demanding the rhythmic traction of the tongue, they are in the way. They may slip into the trachea, and cause pneumonia or asphyxia. Case 242. Lyman's collection: "A patient was

passing into stage of insensibility, her respiration became laborious, her countenance livid, her pulse weak, and all symptoms of suffocation appeared. She coughed up some bloody mucus and died. The tongue was pulled forward and with the finger a metallic plate of artificial teeth was drawn out of pharnyx. Death from suffocation." In children, look for loose temporary teeth, so as to be on guard, in case the use of the tongue forceps becomes necessary. Rough handling can dislodge a tooth, and its intrusion into the trachea can cause suffocation.

13. Always see that all articles of dress are loosened and that there are no constrictions about waist or neck. Such constrictions impede the circulation and the respiratory movements. The Hyderabad Commission found that tight lacing greatly increased the risks of chloroform administration, on account of the imperfect respiration and the consequent tendency to asphyxia to which it gave rise.

14. Always smear nose, chin and lips with vaseline or cold cream, or oil, or glycerine. Use a piece of clean gauze and not your finger. Ether and chloroform irritate the skin and the mucous membranes. By taking this precaution the patient is protected from an annoying postoperative erythema or dermatitis. "Applied to the skin, chloroform is a powerful irritant, and if the contact be

prolonged and evaporation be prevented, vesication will ensue." (Willard and Adler.)

15. Always cover the eyes of the patient with a folded towel or piece of gauze. This is to prevent the irritation of the conjunctiva that follows its exposure to the fumes of ether or chloroform. It also protects the eyes from any ether or chloroform that might accidentally be spilled on the face. Once complete anesthesia has been induced, this can be removed so as to enable you to watch the pupils. Be careful not to pour any of the chloroform or of the ether in the patient's mouth.

16. Keep the patient's arms to side of body, and feel pulse at facial or temporal arteries. Arms must not be pinned over patient's chest. A good way is to flex forearm on arm and then pin lower part of sleeve of forearm to upper part of sleeve of arm. See that arms do not hang over sharp edges of operating table. See that they do not lie between the border of the operating table and the body of the operator or any of his assistants. Do not place the patient's arm under his head and do not bring it in that position so as to palpate the radial pulse. The facial and temporal arteries give you equally good information and do not expose your patient to postanesthetic paralysis. For the same reason do not allow the patient's legs to hang over the edge of the table.

Among the reported cases of postanesthesia

paralysis, some have been due to compression, others to traction of brachial plexus or some of its branches by the arm having been pulled over head of patient. Others have been due to the arm having been caught as in a wedge between the operator and the operating table. The elevation of the arms lessens the costo-clavicular interspace, and thus can cause compression of the brachial plexus or of some of its branches. In the vast majority of cases postanesthesia paralysis is due to a lesion of the nerve-trunks. It is a "peripheral paralysis." It is always (excluding the very rare cases in which it may be due to the rupture of a cerebral vessel during the stage of excitement) due to direct or indirect pressure upon a nerve or nerves during the administration of an anesthetic. When due to this cause, it is preventable in every instance. Though the upper extremities are most commonly affected, it may also involve the lower extremities. Some cases of postanesthesia paralysis have been caused by the elbows of the anesthetist resting heavily upon the clavicular region of the patient and pressing upon the brachial plexus. (Leszinsky.)

17. Let there be no unnecessary exposure of the patient's body to cold. Anesthetics tend to reduce the temperature; hence, in administering them, rational measures should be adopted to prevent loss of heat. Maintain the patient's body-temperature before, during and after the operation. Have his

bed warmed by hot bricks and hot-water bottles. See that he does not lie in a puddle of cold water during the course of anesthesia. Object: To prevent chilling of body and consequent bronchitis and pneumonia. In discussing after-ether pneumonia, Buxton says: "That removal of the patient to a cold ward after he has been in a warm operating room and subjected to severe surgical shock, has been the true cause of the lung trouble in many cases." Chilling of the surface of the body produces congestion of the internal organs. Hyperemia of an organ predisposes it to inflammation. If to the hyperemic condition of the renal and pulmonary parenchyma is added the irritating action which attends the inhalation of ether and chloroform (not as marked with chloroform) by the lung, as well as their elimination by the kidneys and the lungs, inflammation can easily be excited in these organs. Prevention is more certain than cure.

18. Remember that all methods that employ a large quantity of anesthetic are faulty. A skilled anesthetist will use much less anesthetic to induce and maintain anesthesia than one who is unused to the administration of anesthetics. "The amount of the anesthetic used, no matter which one it may be, bears a direct proportion to the amount of shock, exhaustion, pulmonary edema, pneumonia or nephritis that develops after anesthesia." (Bennett.) Certain operations require that the patient

should be more deeply under the influence of the anesthetic, and so necessitate an increase of the amount to be used. All operations on the rectum, on the urethra and the perineum are of this kind. All methods involving marked asphyxial symptoms are subject to grave objections.

19. Never crowd the anesthetic. It is the large dose inhaled at once that causes death. If the operator asks of you to push the anesthetic, bear in mind, that though his time may be very valuable, the patient's life is much more so. During my interneship at Cook County Hospital I witnessed two deaths that were caused by crowding the anesthetic. "The pushing of the anesthetic vapor so as to get a rapid anesthesia at all risks, is as dangerous a plan as could be possibly devised." (Sir B. W. Richardson.) "Hasty saturation of tissues with a powerful anesthetic may cause speedy death." (Hare.) Pushing the inhalation of a poison from the start overwhelms the vital centers, while its slow administration habituates them to it.

20. Never give an anesthetic to a woman unless a third person be present. This is suggested for the comfort of the patient and for your protection. There are cases on record where the patient has accused her medical attendant of assault while he had her under the effects of the drug. These accusations were brought forth either for the pur-

pose of blackmail, or because the patient had experienced, during the anesthetic sleep, an orgasm of which the anesthetizer appeared to be the cause.

21. In giving an anesthetic do not relax your vigilance from the beginning to the end. Attend to the anesthetic and to the anesthetic only. Remember that no one guide can be entirely relied upon to the exclusion of all the others. All the guides, such as the condition of the pupils, the nature of the respirations, the force and frequency of the pulse, etc., are of value and must all be taken into consideration during the induction and maintenance of surgical anesthesia. Deaths have occurred in all stages of anesthesia. Accidents are sudden, and, not to be fatal, must be detected at their inception. The anesthetist should not watch the operation. (Phocas, le Nord Médical.) While it is not necessary or safe for the anesthetist to watch the operation, he should know how it is progressing, so as to stop the anesthetic when it is no longer required.

22. Do not, as a routine measure, complicate anesthesia by the use of such agents as morphine, atropine, etc. By their action on the respiration, on the pulse and on the pupils, they mask the patient's real condition. There are exceptional instances where these agents can be properly used. Morphia, given previous to beginning the administration of the anesthetic, increases the liability to

vomiting during anesthesia. Analysis of 15,000 anesthesias collected by the Society of Scandinavian Surgeons (March 1, 1894, March 1, 1895) showed that vomiting occurred in ether anesthesia without injection of morphine in 14 per cent; with morphine, in 25 per cent. Chloroform, without injection of morphine, in 10½ per cent; with morphine, in 14 8-10 per cent. Morphine is a respiratory depressant. Morphine interferes with the motility of the iris. Those agents, such as morphine and atropine, interfere with means employed for resuscitation if the patient gets into a dangerous condition. For instance, the effects of morphia would last longer than the effects of the anesthetic, and the morphia could not be counteracted by any other drugs than those that would be employed to resuscitate the patient from the anesthesia-narcosis.

23. During anesthesia, from time to time, turn patient's head to either side so as to allow the escape of loosened secretions from mouth and nose. Rotation of head on trunk has little or no influence upon respiration. This procedure facilitates the outflow of mucus and saliva from mouth. These, during anesthesia, tend to induce cough, and if swallowed, favor retching and vomiting. Coughing, retching and vomiting, when caused by swallowed saliva, and mucus, mislead us into thinking that patient is recovering consciousness, and incite

us to give him more of the anesthetic than he needs. Patients who during anesthesia swallow much mucus are much more liable to be sick afterwards. "Swallowing of much mucus excites post-anesthetic vomiting." (Blumfeld.)

24. Should the patient to be anesthetized suffer from partial or complete nasal obstruction, place a small gag between his teeth before commencing the administration of the anesthetic. Partial nasal occlusion is liable to become complete during anesthesia, by reason of the increased vascularity of the parts. In all operations about mouth, pharynx and lower jaw, it is a good rule to introduce gag, at an early period during the induction of anesthesia. When the tongue is the seat of the growth, pass a thread through its tip before muscular relaxation sets in. This thread will give you a better control of tongue. Should the tongue fall backward, thereby mechanically preventing the entrance of air into the lungs, by pulling thread you can easily pull tongue forward. In operations about face, Souchon's apparatus is very serviceable.

25. Sudden change from recumbent to vertical posture during anesthesia must be avoided. Danger of syncope. It is always far more convenient for the anesthetist, and it is also safer for the patient, if he be anesthetized upon the operating-table. "The extent to which a patient has to be

moved about while under an anesthetic affects his liability to after-sickness." (Blumfeld.)

26. Room, in which the anesthetic is administered, must be quiet. Conversations and noises excite the patient's attention and retard the production of anesthesia. If there is a burning gas-jet in the room, see that ventilation is assured. Chloroform, in being decomposed by the gas-flame, liberates free chlorine. This gas is a respiratory irritant, and can cause bronchial irritation in operator and assistants, and asphyxia in patient. If chloroform is to be administered in a room lighted by gas-light it is imperative that free ventilation be secured. Patient must not be anesthetized beneath a gas-flame. "Chloroform, if given, in an unventilated room near a gas-flame, excites in the attendants present in the room a choking and stinging sensation in the throat and chest, resulting in incessant coughing." (Winslow.) These symptoms of bronchial and laryngeal irritation, such as a constant, dry, spasmodic and paroxysmal cough, and a feeling of distress and oppression over the chest, are provoked chiefly by hydrochloric and chlorine gas (Hare), these substances being resultants of the changes which chloroform vapor undergoes in the presence of gas, oil or other flame, chlorine gas being the main toxic agent responsible for the occurrence of the accidents. The forementioned symptoms, to which can be added a

stinging sensation in the nostrils, the perception of a pungent odor, etc., are chiefly experienced by the anesthetist. They may, however, affect the patient as well as bystanders. It is not rare for chemists working in small rooms with chloroform and lighted Bunsen lamps to suddenly become attacked with severe coughing. Dr. Mey, Westphalia, reports an operation for gun-shot wound of the abdomen lasting four hours under the influence of chloroform, and in the presence of gas-light, during which the surgeons and sisters in attendance were overcome by the decomposition products of the anesthetic, one sister dying on the second day following the operation. Emil Aronson reports a case in which the patient and the attending physician were killed by these decomposition products.

27. Have patient's head on level with body. "Keep patient's head in extension, but not dropped backward over end of table." (Hare.) Flexion of head on neck lessens the caliber of air way and favors stertor and respiratory embarrassment. "Extension and projection forward and backward, both pull epiglottis away from glottic opening, but in the latter posture the soft palate is strapped over dorsum of tongue and the patient is forced to breathe through his nose, which is often partly or entirely occluded by mucus, by hypertrophies, whereas, when the head is extended and projected

forward, the patient can readily breathe through both mouth and nasal chambers." (Hare.) If patient insists upon having pillow below head, remove it as soon as he is asleep.

28. Keep jaw forward and upward. Falling down of jaw is attended by falling backward of the tongue. The tongue, in falling back, carries with it the epiglottis, and this, by falling back, prevents entrance of air into lungs.

29. Operators must minimize the duration of operations to time consistent with their proper and thorough execution, because the longer the operation the more anesthetic is required. Anesthetics are dangerous per se. Chloroform is a virulent protoplasmic poison. Ether produces a marked diminution in the amount of hemoglobin. The shorter the anesthesia, the less liability there is to after-vomiting and other disagreeable after-effects. The danger of death is present as long as the anesthesia continues. In this connection it must be said that the surgeon must avoid undue delay before commencing the operation. Operation should be begun as soon as the patient is completely anesthetized.

30. Warn the patient, especially if he be an adult, that at first a sensation of choking will be experienced, but that it will soon pass off. When that feeling of suffocation comes he will feel less

alarmed, knowing that he is experiencing the expected. Tell patient that he must not struggle.

31. Patient's struggles should be quietly but resolutely restrained. When a patient struggles he holds his breath. This is disadvantageous, because any obstruction to breathing is very likely to impede the heart's action. If breath is held for any length of time, pulmonary circulation and right side of heart become engorged. With ether the cause of struggling is generally too strong a vapor being administered from the commencement. Give patient a breath or two of fresh air. During struggling, pushing of ether is dangerous.

32. Struggling in chloroform or ether anesthesia may be due to fright, which may lead to resistance; avoid fright by calming patient's fears. Choking or asphyxia is generally due to the cap being held too close to patient's face and to non-sufficient admixture of fresh air with the anesthetic; avoid it by holding mask not too close to patient's face at beginning of anesthesia; give patient a breath or two of fresh air to relieve symptoms. It is also due to an overdose of chloroform or ether. Permit a breath or two of air. If patient struggles violently, and the breathing becomes abnormally deep, give patient fresh air and do not reapply cap till the breathing becomes normal again.

To summarize, the objections to struggling are based on the facts that it interferes with the circulation and unduly taxes the heart, and that it fixes the thorax and embarrasses and often renders respiration impossible.

33. Encourage patient to take deep breaths. They help to overcome the sensation of suffocation. He must also be told not to hold his breath. By holding his breath he debilitates his respiratory center, owing to lack of oxygen furnished to it. Then when the necessity of breathing overcomes all other impulses, a gasping inspiration is taken, the center is flooded with the anesthetic agent, and death may supervene; this is especially liable to occur with chloroform. "Deaths which take place comparatively early in chloroform anesthesia are due primarily to rigidity, struggling and holding of breath." (Hill, Barnard.) If patient complains of suffocation, and struggles or breathes irregularly, remove mask and allow a few breaths of fresh air. Prof. Jno. Ashhurst recommends the following procedure: "Request patient to blow out. The vapor of ether is so irritating to the throat that it is very difficult to voluntarily draw it by deep inhalation, but it is perfectly easy to blow into the cone, and as a full expiration is inevitably followed by a deep inspiration, the surgeon's purpose is most readily accomplished; contrary to what happens when the

patient is directed, as is usually the case, to draw in his breath."

34. Encourage patient to expectorate mucus, and during the anesthesia, if mucus accumulates in pharynx, remove it with gauze sponges held by long artery forceps. Facilitate its outflow from mouth by turning head to one side. Mucus, mechanically, obstructs the entrance of air into the lungs. The swallowing of mucus causes retching and vomiting, both during and after the administration of the anesthetic. If mucus trickles down into the stomach during the operation, the patient is almost certain to vomit, and in most cases the vomited material consists of mucus with some gastric juice and bile.

35. Should the patient begin to vomit during the course of the anesthesia, immediately turn his head to one side and catch vomitus in towel or basin. By the aid of this measure the vomited matter will be ejected from the mouth, instead of being sucked into the larynx. Neglect of this precaution has been followed by fatalities. These have, principally, occurred in cases of fecal vomiting due to intestinal obstruction. It is the anesthetist's duty to see that the vomited matter is removed from the pharynx. Swab out pharynx with a gauze sponge held by long forceps. "During anesthesia, if vomited food has entered the larynx and is not ejected by coughing, it is necessary to promptly perform

tracheotomy and hold the tracheal wound open or introduce a tube, and practice artificial respiration." (Wharton.) If patient has vomited in mask or cone, discard it and take a clean one.

36. Remember that in cases where there has been a severe hemorrhage, the amount of anesthetic necessary to maintain safe anesthesia is small.

37. Should tongue fall backward and embarrass breathing, it is rare that one needs the aid of a tongue forceps to bring it forward. Tongue-forceps often lacerate tongue, and the lesions which they inflict cause suffering for a few days. Use the following method to bring tongue forward. I have often used it, and it has never disappointed me: With fingers (ring and little finger) push forwards and upwards angles of lower jaw; by this procedure the condyles of lower jaw are thrown, so to speak, on the eminentia articularis. This movement will invariably bring forward the tongue.

INCOMPLETE ANESTHESIA.

38. Under no circumstances should incomplete anesthesia be deemed sufficient for even the most trivial operation. See that anesthesia is complete before the operation is begun. If the operator begins operating before the anesthesia is complete, it becomes harder and requires more anesthetic than would otherwise be required to obtain complete surgical anesthesia. The patient being sub-

jected to traumatic irritation, such as cutting and pulling of nerves, the anesthetics act more slowly. Another, and still more valid objection to operating under incomplete anesthesia, is that pain may inhibit the heart's action. Therefore see that there is complete muscular relaxation, abolition of the ciliary, masseter, palpebral and buccal reflexes, and contraction of the pupils (the latter is not required in ether narcosis, but is indispensable in chloroform narcosis) before an incision is made. The conjunctival reflex, when abolished, does not always indicate a corresponding abolition of reflex action generally. I quote from Brunton: "Sudden stoppage of heart is usually ascribed to chloroform, and, no doubt, concentrated chloroform vapor inhaled into the lungs may arrest the heart. Very commonly, though, it is reflex, and when death occurs in such a case it is due to the want of chloroform, and not to its excess. In the great majority of cases recorded, as deaths from chloroform, the statement is made that the quantity used was very small and the anesthesia incomplete; that these operations, though trivial, were dangerous under imperfect anesthesia and not at all dangerous when either no anesthesia was used or when narcosis was complete. The reason for this is probably that when no anesthetic was given irritation of sensory nerves during operation caused two effects—slowing or stoppage of heart

and reflex contraction of vessels. This contraction of vessels neutralizes cardiac weakness, maintains blood pressure and thus prevents syncope. During imperfect chloroform anesthesia, the reflex effect on the heart persists, so that irritation of a sensory nerve may produce syncope by stopping the supply of arterial blood from the heart. In its weakened state it will not pump enough into the arteries, while the blood still flows rapidly into the dilated capillaries and veins." As Hare says, "The man is suddenly bled into his own vessels as effectively as into a bowl." It is perfectly possible for a patient to bleed to death in his own arteries. "Danger of partial anesthesia lies particularly in not keeping reflex action in abeyance. It is essential that both sensation and reflex action be abolished." (A. R. Edwards.) Imperfect anesthesia renders patient peculiarly liable to cardiac failure through afference of sensory impressions conveyed from cutaneous or visceral nerves.

39. If operator notices that the patient's blood is becoming dark, he should tell the anesthetist. The patient is not inhaling enough oxygen, is getting an overdose of the anesthetic or the respiration is obstructed. Withdraw the cap and remove any impediment to the respiration that may be present. This impediment may be an excessive amount of mucus in the throat; may

be a faulty position of the tongue; may be a foreign body in the larynx, pharynx or trachea.

RESPIRATION OF THE PATIENT.

40. See that operator's arms, or those of his assistant, do not rest on chest or abdomen of patient. All things that embarrass the respiratory movements of the patient must be avoided. In pelvic, perineal and rectal operations, bear in mind that all leg supports which pass around the neck and shoulder of the patient embarrass respiration and may by compressing branches of the brachial plexus cause paralysis. The best supporters are those which are attached to the table.

Watch the rate, the depth, the audibility of the breathing and the degree of stertor. "Throughout chloroformization, the respirations must be constantly watched." (Buxton.) The respirations must be regular, deep and of normal frequency. Throughout the inhalation of the anesthetic the breathing must be free and not impeded in any way. The respirations are watched in ether and chloroform anesthesia, because (a) the character of the respirations gives us information as to the depth of anesthesia. (b) The rapidity and the depth of breathing govern the amount of the drug inhaled. An amount of anesthetic which can be given with safety during easy breathing may kill, if given, during exaggerated respiration. For example, a given quantity of chloroform or ether will

exert its greatest effect when the respiration is deep and quick, because the vapor is then carried, in a given period of time, in larger quantity, into the air-spaces of the lungs. The respirations of the etherized patient are usually deeper, quicker and noisier than those of the chloroformed patient.

Movement of the chest wall, or of the diaphragm, is not sufficient evidence that the respiratory function is being carried on properly. The sounds of respiration must be heard, the breath must be felt. If costal respiration becomes feeble, or is replaced by purely diaphragmatical breathing, death will speedily follow if artificial breathing be not immediately resorted to. The value of artificial breathing lies in its property of furnishing oxygen to the blood, of clearing the lungs of anesthetic vapors and of helping on the circulation of the blood.

Marked quickening of respiration means an overdose of the anesthetic, unless it is accounted for by reflex action, such as stretching of the sphincter ani and working with the mucosa of the rectum, or by some mechanical interference with the breathing, as the presence of mucus in the air-passages. Snoring and stertorous breathing are evidences of profound narcosis. Deep, stertorous breathing is usually due to paralysis of the faucial and pharyngeal muscles. Stertor may depend upon the presence of mucus in the throat. Remove it,

with gauze sponges held by long artery forceps. During the course of anesthesia, at times, turn the patient's head to one or the other side so as to allow the saliva and mucus to run out at the side of the mouth. With ether, snoring and stertorous breathing are not necessarily dangerous. To prevent pharyngeal stertor, head must be in such a position as will not bend the neck too far back or approximate the jaw too near the sternum. Turning the head to one side will often give relief. Elevation of the jaw frequently stops the stertorous character of the breathing. In fleshy individuals, and in patients suffering from nasal obstruction, as hypertrophied tonsils, naso-pharyngeal adenoids, etc., snoring and stertorous breathing will persist during entire anesthesia. When breathing becomes stertorous, if chloroform is the anesthetic you are using, cease administration. Then watch for some slight indication of returning reflex action, as a dilating and active pupil, etc. Then give chloroform and reinduce stertor. If ether is the anesthetic agent used, continue its administration, but in doses just sufficient to maintain the anesthesia.

If respiration is embarrassed, see that no obstruction to the entrance of air into the lungs is present, as regards improper position of head; foreign body in mouth, pharynx or larynx; falling backward of tongue and with it of the epiglottis; accumulation of saliva and mucus in pharynx.

See that patient gets more fresh air. In the stage of excitement, breathing is labored. In the stage of surgical anesthesia it becomes regular as soon as the muscles are completely relaxed. The slowing of the respiration is due to the depressing action of the anesthetic on the pneumo-gastric nerve. In the stage of paralysis or collapse, the respirations are slow, sighing, shallow and finally cease.

There are certain reflexes present during full surgical anesthesia, such as those excited by dilating the sphincter ani, by the rough handling of the peritoneum, especially the breaking down of peritoneal adhesions, by the compression or rough handling of the ovaries or testes. These reflexes manifest themselves by an increase in the rate and in the depth of the respiration. During their occurrence the amount of chloroform or ether, being inhaled, should be temporarily diminished; as the increased frequency and increased depth of respiration would, were this precaution not taken, lead to the inhaling of an overdose, and to consequent ill effects.

Give chloroform drop by drop; you thereby give it in its most diluted form with air, and lessen the liability of any reflex action on the vagus. An unduly strong dose of chloroform can cause closure of the glottis. Sudden arrest of the heart or of the respiration in the initial stage of chloroform nar-

cosis has been, experimentally, proved by European observers to be often due to reflex action from the filaments of the trigeminus in the Schneiderian membrane to the vagus. The possibility of this reflex action is much lessened by giving the chloroform in diluted form, and increasing the strength of the vapor very gradually. To counteract this reflex action, some surgeons spray patient's nasal chambers with a weak cocaine solution previous to beginning the administration of the anesthetic.

The direct cause of primary arrest of respiration when ether is given is one of the following factors:

a. Irritation of peripheral filaments of the trifacial, which reflexly causes spasm of the glottis. (Kretzschmar.) This is avoided by giving vapor in diluted form to begin with. If, despite this precaution, it occurs, continuing the administration of the anesthetic will benumb the peripheral filaments of trifacial, and in that way cause relaxation of the glottis.

b. Irritation of the peripheral vagi in the lungs. This inhibits respiratory movements, and momentarily impedes the action of the heart. Here the pushing of the anesthetic benumbs the peripheral ends of the vagi in lungs and thus puts a stop to the irritation.

c. Spasm of muscular fibers of smaller bronchial tubes induced by the irritant vapor of ether. Con-

tinue to administer the anesthetic, and the muscular fibers of the bronchial tubes will soon relax, and breathing will take place. By gradually giving the anesthetic, that is, gradually increasing the strength of the vapor, the feeling of suffocation and spasm of glottis are rarely produced, and stertorous breathing and lividity of face are not frequently seen. In the respiratory forgetfulness which, at times, occurs at the beginning of ether anesthesia, pour some ether on patient's abdomen. The sensation of cold which attends the evaporation of this substance will reflexly excite respiration.

CONDITION OF THE CIRCULATORY SYSTEM DURING ANESTHESIA.

41. The condition of the circulation during anesthesia. Before beginning to administer the anesthetic, locate the facial or temporal artery. During the course of anesthesia, these arteries are to keep you informed of the strength and of the rate of the heart's action. A weak heart, a weak pulse; a labored heart, a thready pulse. The color of the face, lips and ears will also give you information as to the heart's condition. It shows the activity of the capillary circulation. The fall of blood pressure, which is the normal condition of anesthesia with chloroform, is due to the action of chloroform on the vasomotor center in the medulla oblongata. During the stage of excitement the

pulse is accelerated; a frequency of 144 pulsations to the minute has been reported. Usually the more marked the excitement, the greater the frequency of the pulse.

In the stage of surgical anesthesia, the pulse loses in frequency, and acquires fullness and compressibility. If the administration is now continued with care, the pulse will not lose these qualities during the entire duration of the anesthesia. In the stage of paralysis the pulse is rapid, feeble, fluttering, finally ceasing or stopping suddenly without warning. When the pulse becomes rapid, 130 to 160 in children, 120 to 140 in adults, resort to stimulation; use strychnine sulph. gr. 1-20; use tr. digitalis, m. xv. to xxv. It is needless to say that during anesthesia these agents must always be given hypodermically. If the pulse seems feeble, slow, irregular, intermittent, the anesthetic must be withdrawn and fresh air freely admitted till improvement occurs. Respiration and circulation may cease simultaneously on section of a nerve.

There is an increased frequency of the pulse, when, though the thorax is rising and falling regularly, no air is entering the lungs; when patient is about to vomit (pulse also becomes irregular previous to vomiting); after considerable loss of blood; during stage of excitement; during manipulation of a considerable portion of the intes-

tines; during dilation of anal sphincter; during operations in cervical regions, when cardiac accelerating branches of pneumogastric may be irritated; at the beginning of anesthesia pulse may be rapid from fear.

There is a decreased frequency of the pulse in cranial operations; in operations in the cervical regions; when cardiac inhibitory branches of pneumogastric nerve may be irritated; in case of pressure or traction on the diaphragm; during gastric operations.

Sudden stoppage may appear, momentarily, from any of the following causes:

(a) Severing a nerve in amputation.

(b) Sudden escape of the contents of a cystic tumor.

(c) Upon removal of a large abdominal tumor. (In frogs, exposure and irritation of the intestines will stop the heart.)

(d) Pressure on testicle or spermatic cord, during hernial operation.

(e) Ligation of an ovarian pedicle.

(f) Spasmodic contraction of diaphragm preceding vomiting.

(g) Dilatation of anal sphincter.

42. Condition of the muscular system during anesthesia. Muscular movements during stage of excitement are violent, purposeless and most always independent of the will. The voluntary

muscles are the first to be influenced by anesthetics. It is important to note that the involuntary muscles are, so to speak, refractory to the influence of anesthetics. It is rare for patients during anesthesia to pass urine or to void feces.

The usefulness of obstetrical anesthesia is based upon this nonpredisposition of the involuntary muscles to the action of anesthetics.

In the period of rigidity which precedes that of relaxation, if the breathing stops for more than a moment, practice artificial respiration.

Anesthesia is not complete before complete muscular relaxation has set in. Perfect relaxation of limbs is an indication that the patient is ready for the operation. During the stage of excitement, the patient struggles because he believes himself asphyxiated. The jaws are more or less fixed. Excitement and struggling gradually subside. Buccal paralysis accompanying respiration indicates that patient is going under. A little later, snoring and stertorous breathing indicate faucial and pharyngeal paralysis and that the stage of surgical anesthesia has been reached.

In the stage of surgical anesthesia the muscles are relaxed (if the arm is raised it falls back of its own weight); jaws are relaxed. If during anesthesia, patient regains control of the jaw, he is recovering consciousness. In the stage of paralysis, muscles are in the same condition as in the pre-

ceding stage. All patients in going under with ether pass through a stage in which there is more or less rigidity. Pushing the ether does not overcome, but prolongs, the rigidity, whereas withdrawing the ether brings relaxation of muscles without return to consciousness.

CONDITION OF CENTRAL NERVOUS SYSTEM.

43. Condition of Central Nervous System: In the stage of excitement, patient seems intoxicated. There is a quick succession of ideas, of strange sensations, of hallucinations. Ideas become incoherent. Patient becomes drowsy. Cerebral torpor overtakes him. Delirium may be mild, may be violent. Excitement and delirium are due to marked hyperemia of brain. Excitement is most marked in robust, strong people and in alcoholics. Sensibility is impaired. Stage of surgical anesthesia. The patient is calm; his brain anemic; sensation is abolished. This is due to suppression of the function of the sensory nerves. State of paralysis same as the preceding. "Ether," says Hare, "depresses first the perceptive and intellectual cerebral centers, next the sensory side of the spinal cord, then the sensory and motor portions of the medulla oblongata; and with this depression, death ensues." The motor centers of the cord are affected later than the spinal sensory centers. This applies also to chloroform, both drugs acting similarly on the nervous system.

44. Watch carefully the color of the face, lips and lobes of ear. Blanching of these parts may occur and must never escape notice. It is a sign of impending danger. By pinching the ear and watching how rapidly the capillaries refill, and noticing whether the ear returns to its normal redness, you get an idea of the activity and of the condition of the circulation. Cyanosis, though more marked in ether narcosis, is of less importance than in chloroform anesthesia. If patient's face becomes dusky, give him fresh air. In the stage of excitement, follow patient in his efforts to get away from cone or mask and keep it applied to his face.

45. Stage of Excitement: The face is congested. This congestion is due to the turgescence of the superficial vessels. Stage of surgical anesthesia; face resumes a more normal color, and may become covered with a viscous perspiration. Stage of paralysis or collapse; face deeply cyanosed and veins distended or face is suddenly blanched. This blanched appearance indicates impending trouble. At slight indication of blanching of the face remove the mask, allow the patient a few breaths of fresh air. Pallor indicates that circulation is depressed either by surgical shock, insufficient breathing, or an overdose of the anesthetic. A certain degree of pallor and a slow, rather feeble pulse are not necessarily indicative of danger.

They often precede vomiting, and, when so caused, need occasion no alarm; they often precede respiratory failure, and by putting the anesthetist on his guard enable him to avoid this serious condition.

Cyanosis means embarrassed respiration. It indicates that the patient is not inhaling enough oxygen, is inhaling too much anesthetic. It is most often met with in stout, short, thick-necked people, and necessitates a more careful adjustment of the head and close attention to the patient. It may be due to accumulated mucus, to a faulty position of tongue, to a foreign body in the trachea. Relieve it by removing the cause. A turgid condition of veins of head and neck, associated with a dusky color of surface, especially if there be muscular rigidity, with a rapid and irregular pulse and an excited state of the respiration, should always lead to a temporary suspension of the inhalations.

REFLEX ACTION.

46. Coughing and swallowing, in the very early stages of anesthesia, point to too strong a vapor and should be met by a diminution in its strength. Should they tend to arise after surgical anesthesia has become established, they should be met by increasing the strength of the vapor, because they then indicate that the patient is recovering from the effects of the anesthetic. The function of

deglutition during profound anesthesia is suspended. The presence of the pharyngeal reflex (the act of deglutition excited by the presence of the anesthetic vapor or mucus) indicates that more of the anesthetic is required. In the stage of excitement, the cornea is sensitive, reflex action continues, pupil dilates and reacts to light.

Stage of Surgical Anesthesia: All the reflexes except those of the involuntary muscles are abolished. By keeping these reflexes barely abolished, a patient may be kept in this state for hours. The abolition of reflex action denotes that the operation can begin. By carefully watching the pharyngeal reflex, and keeping it abolished, coughing, retching and vomiting can, with very few exceptions, be prevented during the course of the operation. This is a fact of no small importance, in abdominal, rectal and perineal surgery.

The patient may cough at first; this is due to direct irritation by anesthetic vapors of the superior laryngeal nerve filaments. This cough is, usually, slight and transitory; however, should it persist and be associated with dyspnea, suspend the inhalations till quiet is restored.

When stomachic disturbance is evidenced by the rapid dilatation of the pupils, by the spasmodic contractions of the diaphragm, by short, convulsive movements of the abdominal muscles, by rapid, short, jerky respirations, with a pulse of

increased rapidity and by repeated efforts at deglutition, vomiting will soon take place, in almost all instances. Pushing of the anesthetic if it succeeds in abolishing these reflexes, will prevent vomiting. As soon as it is apparent that the patient will certainly vomit, remove the mask, turn the head quickly to one side, always to the side away from the field of operation, catch vomit on towel, and clean mouth and pharynx. As soon as vomiting has ceased, resume anesthesia.

Under ether, the pupils contract at first, and then remain moderately dilated during surgical anesthesia.

The observation of the pupil is of great importance during chloroform anesthesia. Its behavior while the patient is under the influence of this anesthetic furnishes us invaluable information concerning the stage and the depth of anesthesia, and the condition of the patient.

The third nerve center which governs the pupil, unlike the respiratory center, is not a vital center. In the stage of excitement, the corneal reflex is present, and the pupil is dilated and reacts. When the patient is going under or coming around, the dilatation and the activity of the pupil that are present are thus explained. The dilatation occurs because mental, sensory and sympathetic impulses affect the half narcotized cerebrum and cause reflex inhibition of the third nerve center. The activity

of pupil is due to the fact that the center itself has not been reached by the anesthetic. A similar dilatation of pupil is produced, under ordinary circumstances, by fright, pain or a blow on the abdomen.

As long as the pupil dilates in response to sensory stimuli, such as the pinching of the skin, etc., anesthesia is not sufficiently deep to allow the commencement of the operation. Vomiting causes dilatation of pupil similar to that which occurs when patient emerges from the anesthetic state.

State of Surgical Anesthesia: Corneal reflex is abolished; pupil is contracted; myosis. A contracted pupil is a sign of complete and safe narcosis. We must endeavor to keep the pupil contracted. Operator may now begin. This contraction of the pupil occurs because all the cerebral reflexes are barred and the third nerve center is consequently unimpeded. The center of the third nerve is now only inhibited by the light reflex. The same condition occurs in deep sleep.

Stage of Paralysis or Collapse: Corneal reflex is always abolished. The Narcotic has reached the nerve center and gradually overwhelmed it; consequently nerve control has ceased. The pupil dilates widely and the light reflex is abolished. Withdraw chloroform till contraction of pupil occurs as a result of the recovery of the third nerve center. Dilated and fixed pupil denotes danger of imminent syncope of respiratory center. Respiratory

syncope is the most common cause of death from chloroform anesthesia. Use restorative measures. "Failure of the pupils to respond to light, or their wide dilatation is a sign of approaching danger. The inhalation should be at once discontinued, the head lowered, the tongue drawn well out of the mouth, the heart stimulated, and artificial respiration begun." (Am. Text-Book of Surgery.)

During the course of the anesthesia, the pupil may dilate gradually, may dilate suddenly. The gradual dilatation of the pupil denotes that patient is recovering from the anesthetic. Resume the administration of the chloroform and continue it drop by drop until the pupils again become myotic. Then suspend the administration. In a few moments, when the pupils again show a tendency to dilate gradually, administer some more chloroform, and keep on in this way, always maintaining the pupils contracted. The sudden dilation of the pupils denotes that the third nerve center has been overwhelmed by the anesthetic. It is a serious condition. It must at all hazards be avoided. This sudden relaxation of the iris, under chloroform, is a part of the relaxation of death. Upon its occurrence, immediately cease the administration of the chloroform, invert the patient, practice artificial respiration, and resort to stimulation. The first three measures are by far the most valuable.

When with symptoms of asphyxia, pupil is con-

tracted and remains contracted (it suddenly dilates in this condition when cause being uncounteracted verges on a fatal result), the asphyxia is due to some mechanical obstruction to breathing and not to an overdose of chloroform. This condition can easily be remedied, and should never prove fatal.

Per contra, if the chloroform be present in an overdose, the pupils are always dilated. The dilating and active pupil of the stage of excitement and of insufficient narcosis can be distinguished from the dilated pupil of deep narcosis or collapse by the greater freedom of the light reflex, by the supervention of other reflexes, such as cough, vomiting, irregular breathing and by the absence of the glassy fixation of the eyes so characteristic of profound narcosis.

47. During the course of anesthesia, do not stimulate your patient with hypodermics of strychnia, sulphate, nitroglycerine, etc., unless it is absolutely necessary. Do not get needlessly alarmed. Do not annoy the operator with unfounded fears. Most always alarming symptoms disappear by just permitting the patient to come a little from under the anesthetic.

A FEW POINTS CONCERNING CHLOROFORM ANESTHESIA.

1. Always reduce to the minimum consistent with full and complete anesthesia, the amount of chloroform vapor inhaled. This also applies to

ether. Usually the more of the anesthetic absorbed, the longer is the interval before consciousness returns. It is impossible to find a dosage that will do for all patients. The individual must be studied, and the only person that can do this is the educated anesthetizer. "Patients vary as to the quantity of the anesthetic needed and time consumed in anesthetization. This depends upon the method of anesthetization and the type of patient. In general, it may be said, males require more of an anesthetic than females; muscular and stout subjects more than thin; plethoric more than anemic; nervous more than sanguine; those poor in intellectual development more than the highly developed; the healthy more than those suffering from prolonged illness; the non-septic more than the septic, though it occasionally occurs that some septic individuals require a surprisingly large quantity of ether; those addicted to the use of drugs, as alcohol, morphine, more than those not so addicted." (Goldau.) Do not administer chloroform from a towel. An overdose is too easily given this way. "Chloroform usually kills by its depressing action on the heart, and it seems highly probable that it often does this by the property which it has been shown to have, of destroying the contractile power of the cardiac muscle when it reaches it in a sufficiently concentrated form."

(Am. Text Book of Surg.) By autopsies and experiments Heintz (Journ. de Med. et Chir. Prat., October 9, 1898) has proven that chloroform inhaled for long periods produces, through a slow secondary action, pathological changes in the organs, capable of causing death, one or several days after the anesthesia. By lessening the dose of chloroform, the liability to undesirable after-effects is lessened. In the causation of vomiting after ether or chloroform anesthesia, one of the most important etiological factors is the amount of anesthetic used.

2. Avoid the continuous action of chloroform on the organs by allowing at least one week to elapse between two chloroformizations in the same individual. The elimination of chloroform inhaled is only completely effected in about a week. The secondary action of chloroform exhausts itself also in about a week. Both elimination of the chloroform inhaled and its secondary action must be at an end before more chloroform is introduced in the system. Schenck objects forcibly to the practice common in gynecological clinics of narcotizing individual patients frequently at short intervals for the purpose of establishing a positive diagnosis.

3. Always be very watchful while administering chloroform, and in fact any anesthetic, to individuals suffering from renal or hepatic insuffi-

ciency. These subjects offer to chloroform, as they also do to other intoxicants, as, for instance, sepsis, an impaired resistance.

4. Use an Esmarch inhaler in administering chloroform. "Esmarch chloroform mask is the cleanest, safest and best." (Mellish.) Put two or three thicknesses of gauze over the mask. Change gauze for each anesthesia. Should the patient vomit in the mask and soil the gauze during the course of anesthesia, change the latter. Give this agent well diluted with air. Give it drop by drop; the danger of an overdose is thereby lessened. In the absence of a drop-bottle, use a one or two-ounce bottle and an ordinary cork. Cut a shallow groove on one side of the cork, and put in this groove either a thick silk ligature or a small strip of gauze extending into the chloroform. Cut a shallower groove on opposite side of cork. In partial inversion of the bottle, the chloroform will flow from bottle drop by drop. The rapidity of outflow is controlled by the position of the bottle. "Quantity is the all important factor in chloroform anesthesia. I am convinced that death is nearly always due to unskillful administration, and that unskillful administration is the administration of an overdose." (Waller.) Chloroform should always be given with about 95 per cent of air. Paralysis of the heart may result from the inhalation of too concentrated chloroform vapor. From

six to ten minutes are usually required to secure surgical anesthesia by the aid of chloroform.

At the beginning of anesthesia, hold inhaler some inches from mouth and nose, so that chloroform will be diluted with air. By doing this, the sense of suffocation which is so trying to the patient, and so provocative of struggling, will often be prevented. Asphyxia taking place within a few minutes from the commencement of the anesthesia can be caused by a too highly concentrated vapor of chloroform. If the patient struggles violently, breathes irregularly, or holds his breath, remove the cap and let him take a breath of fresh air before administration is proceeded with. In beginning anew to place the chloroform-mask over the face of a patient upon whom its use has been discontinued on account of some serious signs, the vapor should be carefully and slowly given, otherwise fatal syncope may follow in a heart already affected by a previous overdose.

5. The following conditions, occurring under chloroform anesthesia, are signs of impending danger:

(a) Sudden and complete dilatation of the pupil.

(b) Shallow, sighing respirations.

(c) Absence of pulse; rapid, irregular or intermittent pulse.

(d) Sudden paleness or sudden lividity of countenance.

A FEW POINTS CONCERNING ETHER ANESTHESIA.

To administer ether you can use a cone, in the apex of which you stuff some gauze sponges. The Allis* inhaler is a good apparatus. Complicated inhalers are cumbersome, they have no distinct advantage and have many decided disadvantages. (Hare.) The requirements of an ether inhaler are simplicity, cleanliness, inexpensiveness, portability and adaptability to safe etherization.

With it, the amount of air can be easily and quickly regulated. With it anesthesia is begun by a free administration of air and drop by drop administration of ether upon parallel bandages. Drops are rapidly increased in number, so that by the end of the first half minute a tiny stream, resembling a bead-like chain, will be going into the inhaler. At the same time the top of the latter is gradually closed in and the administration of air is thus shut off.

*The advantages claimed for this inhaler by Dr. Allis are:—It gives the patient the freest access of air. It is a mistake to suppose that air must be excluded. All that is necssary is that the air should be saturated with the vapor of ether. The inhaler affords a series of thin surfaces upon which the ether can be poured, and from which it will almost instantly evaporate. By leaving the instrument open at the top, the supply can be kept up constantly, if desired; and as ether vapor is heavier than air, there is no loss by not covering it. The top should never be covered. The inhaler does not cover the patient's eyes, does not terrify him, and he often passes under the influence of the anesthetic without a struggle.

If ordinary cone is used, the ether is poured on the gauze sponges and distributed as evenly as possible. New gauze sponges should be used for each case. Ether should be given so that air is present in the proportion of about 5 per cent while patient is struggling. Always begin administering ether slowly, increasing the amount gradually. The inhalation of ether is made unnecessarily disagreeable by those who brutally insist on employing the so-called rapid method, accomplished by crowding the cone tightly over the patient's face, and holding it there in spite of his most strenuous efforts to secure comfortable inspirations. (Gallant.) Air slightly impregnated with ether is the first rule, and ether impregnated with air the second. In using ether do not drench patient with the anesthetic. In giving ether, it is the safest way to give with the first few inspirations vapor much over-diluted with air and gradually and systematically increase the strength of vapor at each following inspiration. If at the beginning of anesthesia ether vapor be inhaled in too concentrated a form it usually excites a momentary arrest of respiration and a decided sense of suffocation. These phenomena are due to the irritating action of ether vapor upon the mucous air passages. If the patient coughs or holds his breath, the vapor is too strong. The inhaler should be removed and gradually brought closer again. Impress upon

patient that he is perfectly safe, and encourage him to breathe deeply. Ether, being irritating to mucous membranes, can, if given too strong, cause spasm of glottis and other serious reflex acts. Once patient is under the influence of ether, decrease the dose inhaled and keep the patient anesthetic and docile with as small a quantity as possible. On the average, eight to fifteen minutes are consumed in producing ether anesthesia (12½ min. Anna E. Blount.) In ether anesthesia the variations of the pupil do not possess the significance that they do in choloroform anesthesia. Hence the giving of atropine, though it dilates the pupil does not complicate the anesthesia as much as it would, if chloroform were the agent inhaled. In one hundred cases in which C. L. Gibson gave atropine previous to the etherization, he noticed that it did not prevent vomiting, that it lessened the bronchorrhea, that it acted as an efficient stimulant. The administration of atropine can be serviceable as an aid in preventing bronchial complications. When ether is given in abdominal operations, atropine prevents an hypersecretion of mucus. Atropine by preventing the plugging of the bronchi, which often results from an hypersecretion of mucus, lessens the liability to pulmonary complications. These conditions are serious after abdominal operations, owing to the want of expelling power from inhibition of the abdominal

muscles. When giving ether, avoid proximity of lighted gas jets, candles, etc.

Pulmonary complications following etherization are less likely to occur if care is taken to see that the patient who has taken ether is not exposed to draughts and is not allowed to go out into the cold or moist air, immediately after taking the anesthetic.

"The following," according to Anders, "are the chief causal factors of ether-pneumonia:

"(a) The carrying of the patient from a warm operating room through a cold corridor to a room or ward with a lower temperature.

"(b) Exposure to cold during a protracted operation (catching cold).

"(c) Bronchitis, coryza, or other morbid state of the respiratory mucosa, at the time of anesthesia.

"(d) Dried secretions or incrustations of foreign matter that are loosened by the ether and drawn downward into the lungs, particularly if the head be not kept comparatively low and turned from time to time.

"(e) Use of ether in abdominal operations—partly due to the more protracted etherization, thus rendering the bronchi more susceptible; partly due to the fact that, after these operations, coughing excites great pain, and hence is re-

strained, with retention of the bronchial secretions."

POST-ANESTHETIC TREATMENT.

1. After the patient is returned to his bed, the anesthetist or an attendant must remain with him until he recovers consciousness, in order to guard against his choking by vomiting, to guard against dropping backward of the tongue, and to detect and control hemorrhage should it occur. No pillow should be placed under his head before he recovers full consciousness. A pillow placed below the head lessens the caliber of the air-passages, embarrasses respiration, thereby retarding recovery from the effects of the anesthetic. Have the bed warmed, using hot bricks or hot water-bottles. If the operation has been attended by much loss of blood, elevate the foot of the bed, give normal saline solution per rectum or subcutaneously. The garment which has been saturated with patient's perspiration during the operation, or wet by the irrigating solutions, should be removed immediately upon completion of the operation and a warm, dry nightdress substituted.

Immediately after discontinuance of the anesthetic, if the nature of the operation permits it, turn patient on the side, or if this cannot be done, turn the face to one side. Through this procedure, the mucus tends to flow out of the mouth, the tongue gravitates into the cheek of dependent side,

the respiration is unobstructed and the stertor ceases. No food should be given until the patient calls for it. The taste of ether is best overcome by moistening the lips with lemon juice. After vomiting has stopped, water can be given freely to the patient. If the stomach is unretentive, water can be given in the form of normal saline solution per rectum. This raises the arterial tension, quenches thirst and expedites the elimination of the anesthetic from the system.

If during the course of the anesthetic, some of the anesthetic has fallen into the conjunctival sac, to prevent a conjunctivitis, instill a few drops of 2 per cent sterile cocaine solution in conjunctival sac. For erythema or dermatitis due to the action of the anesthetic vapor, use zinc oxide ointment.

On the day following the administration of the anesthetic, I give a saline cathartic and a diuretic mixture, so as to secure as thorough elimination as possible of the anesthetic agent. The anesthetic is not eliminated entirely by the lungs; the other excretory organs aid in its elimination. "Water should be given per os and rectum as freely as practicable, after anesthesia, as an aid to the emunctories." (Mellish.)

ACCIDENTS.

The accidents of anesthesia admit of the following classification: Immediate and late. Immediate accidents are those that occur during

the inhalation of the anesthetic or before the patient has recovered consciousness. In meeting these accidents keep cool, and remember that promptitude of action is imperative. For example, in cessation of breathing, artificial respiration must be practiced immediately, as chloroform can kill the patient between the suspension of respiration and its attempted restoration by artificial means. As a rule, in the minor accidents of anesthesia, what the patient needs is more air. These minor accidents disappear if the anesthetic be withdrawn entirely.

1. Ether, being explosive, if administered near a lighted candle or other flame, an explosion can occur. If it does,

(a) Instantly cover patient's face with towel or pillow to prevent burning.

(b) Remove ether and ether cone from vicinity of flame.

2. During the period of muscular rigidity which precedes that of relaxation, the breathing sometimes ceases. Dash some ether on abdomen. Practice artificial respiration if condition persists.

3. Asphyxia.—It is a grave condition. If it be due to falling back of tongue, foreign body, or other mechanical obstruction, remove the impediment. These conditions will not occur if proper precautions have been taken. If asphyxia be due to a mechanical obstruction, the obstruction must

be removed, otherwise artificial respiration will be ineffective.

b. Tetanic fixation or relaxation of respiratory muscles. Practice artificial respiration. Sylvester's method is the method I have always used. Most authorities prefer it to the other methods.

4. Syncope.
   a. Initial.
   b. Secondary.

(a) Initial syncope, due to a sudden arrest of the heart's action. This has only been observed in chloroform anesthesia. It occurs at beginning of anesthesia, and is attributed by some authors to a pathological condition of the nervous system, favoring an abnormal and rapid saturation of the whole or of one of the most important parts of the nervous system.

(b) Secondary syncope, occurring more or less rapidly during the course of anesthesia, and usually during the surgical period when the patient is subjected to the depressing effects of the operation, to hemorrhage, etc.

Immediately ascertain if the air passages are patent (as long as the glottis is closed no air can enter the lungs). Protect wound by covering it with sterile gauze-dressing, invert patient, and practice artificial respiration.

Inversion of patient is the most efficient measure to re-establish the circulation of the blood in the

brain. It is the most effieient proeedure to eombat syneope. It should always be resorted to.

Artifieial respiration exereises great influenee upon the eireulation and the respiration. In Sylvester's method of artifieial respiration, it is important that the assistant should grasp the feet and keep them motionless. If this is done, extension and upward traetion of arms above the head elevates and dilates the ehest. This holding of feet is espeeially indieated in ehildren as the lower segment of the body readily follows the ehest in its upward movements. Always begin artifieial respiration by the aet of expiration. By beginning with inspiration you promote further absorption into the blood of the anesthetie vapor present in the bronehi, the bronehioles and the air-vesieles. Bring arms down elose to body, eompress firmly the thorax, and then elevate the arms. To determine the relative values of Sylvester and Marshall Hall's method of performing artifieial respiration, Prof. Hare eonducted some experiments. He eonneeted the respiratory traet with an ordinary gas meter properly adjusted by means of a two-way tube through one valve of whieh the air entered readily, while it eould only eseape through the meter. Curare was used to prevent voluntary breathing. When the Sylvester method was used, the quantity of air passing out of the ehest equalled 62, when that of Marshall Hall was

employed the quantity was represented by 22. In another experiment the Sylvester method gave 18, while the Marshall Hall gave 8. It is evident, therefor, that the Sylvester is actually by far the best method.

OTHER MEASURES TO COMBAT SYNCOPE.

1. Medicinal measures may be used. You must not rely on them exclusively. Strychnine sulphate is the best agent; it raises arterial tension and deepens the respirations. Digitalis and ammonia may be used. Avoid injecting your restorative agents directly into a nerve or a blood-vessel, so as not to provoke a neuritis, so as not to intoxicate your patient.

2. Excitation of skin by various agents. Heat, cold, flaggellations, electricity.

3. Stretching or divulsion of the sphincter ani. Its value is greatly exaggerated, although it does effect the respiratory function. Its action, however, in very deep narcosis is doubtful. For discussion on this procedure, see Transactions American Inst. of Homœopathy—1896, 1897.

4. Insufflation of air into the lungs through the trachea. Introduce catheter or similar body into trachea and insufflate air either with mouth or with bellows. An excellent method.

5. Laborde's method of rhythmical traction of tongue. Tip of tongue being grasped, it is drawn

out of mouth regularly sixteen times a minute and by reflexly stimulating the respiratory center, it renews respiratory movements in apparently hopeless cases. The tongue must neither be lacerated nor contused. The tractions must not be precipitate. They must be performed methodically and rhythmically.

6. Massage and compression of heart. Rapid friction over region of heart. Heat over cardiac region. Rub the extremities strongly toward the heart. Compress the abdominal aorta. These last two methods are intended to keep the blood in the region of the heart and great nerve centers, where, at least, during the period of shock, its presence is vitally important.

If the above methods fail to restore respiratory action, the patient must not be abandoned until tracheotomy followed, if necessary, by prolonged artificial respiration, or insufflation has been resorted to. Tracheotomy facilitates the access of air to the lower respiratory regions. The accumulation of mucus, the falling backward of the tongue, the constriction of the jaws and other causes contributing to the obstruction or closure of the glottic orifice, renders the passage of air to the lungs through the upper respiratory passages difficult, if not impossible. This operation, supplying a new route, meets an important indication. The operation is benign. Being practiced upon

sound tissues, the canula can soon be removed after recovery of the patient from anesthesia, and healing by first intention results early.

7. Dupage in cardiac syncope occurring under anesthesia advises that normal saline solution be injected in the internal saphenous vein. He expects by this to excite the endothelium of the cardiac cavities.

VOMITING AFTER ANESTHESIA.

"There is no specific to prevent vomiting after anesthesia." (Cheever.)

1. The following procedure is often very serviceable and effective. Saturate a towel with fresh, strong vinegar, and hold it a few inches above patient's face. It should be used directly after the administration of the anesthetic has been discontinued, and kept up as long as indicated. It is free from toxic effects and can occasion no harmful conditions. The theoretical explanation of its action is that, free chlorine, one of the decomposition products of chloroform, is neutralized by the acetic acid. (Lewin.) Chlorine acts as a marked irritant to the pharyngeal mucous membrane and induces vomiting, but the acetic acid soothes the irritated parts and neutralizes the chlorine at the same time.

It has also been claimed that vinegar by its pungency stimulates the respiratory mucous mem-

brane, promotes normal secretion and by its soothing action on peripheral nerve filaments of part, lessens the irritability of the pneumogastric and of its centers and thereby controls reflex condition of vomiting.

2. Application of mustard plaster to hypogastrium.

3. Acetanilid.

Caffeinae cit.

Camphor monobr. aa grj. every hour till vomiting ceases.

4. Cerium oxalate.

5. Gastric lavage, with lukewarm solution, may be done while patient is yet unconscious.

6. Hot water with sodium bicarbonate. (Parmenter.)

7. Wine of ipecac—one drop on tongue every hour for two or three hours.

8. Crushed ice.

9. Cocaine hydrochlorate, gr. $\frac{1}{4}$.

To avoid nausea and vomiting after anesthesia, Blumfield (Lancet) gives the following directions:

1. Use as little of the anesthetic as possible consistent with perfect anesthesia.

2. Wash out the stomach at the close of the operation, when much mucus has been swallowed.

3. Move patient about as little as possible during and after the operation.

4. Place him on his right side in bed.

5. Avoid altering the temperature of the room for several hours.

Late:

Headache. Usually requires a night's rest for its removal. Coal tar products are of service.

Loss of blood, or shock from a prolonged operation, are combatted by high rectal injections of normal saline solution. This solution can be used in severe cases subcutaneously or intravenously. Use it hot (110-115° F.).

Anesthetic chill (rare).—In many cases the chill is chiefly due to the operation. Warm bricks, hot water bottles, rubbing of body with alcohol, rubbing with warm camphorated oil.

Anesthetic stupor.—If this state is prolonged, patient must be stimulated, rubbed with alcohol, made to inhale plenty of fresh air, gentle flagellation of thorax resorted to.

Persistent singultus.—Dram doses of Hoffman's anodyne. Musk, chloral.

Jaundice.—No special treatment.

Post-anesthetic paralysis. — That of similar paralysis due to other causes. Treatment of post-anesthesia paralysis should be preventive as avoiding forced elevation of arm, watching to see that the arm or member is not compressed against edge of table, etc., etc. "The best treatment of paralysis following anesthesia consists in guarding the patient while unconscious from the injurious

effects of pressure produced by unnatural positions." (Mally.) "Local faradization is indicated in paralysis from compression, and passive movement of the articulation to prevent stiffness. If the electric tests disclose degenerative atrophy or severe reflex paralysis, localized electric treatment is contraindicated. In the latter case, the reflex medullary irritability should be soothed with static electricity, and possibly revulsion on the spine with spark friction." (Mally, Revue de Chirurgie.)

Albuminuria and Glycosuria may follow the administration of ether or chloroform. They are usually temporary conditions. For treatment, consult text-books on practice of medicine.

Finally allow me to quote, from J. W. Guest, eleven don'ts for the anesthetist:

"1. Don't go to sleep yourself.

"2. Don't neglect your patient.

"3. Don't be overconfident. It is best to fear.

"4. Don't allow friends, relatives or the surgeon himself to alter your judgment in the administration.

"5. Don't stimulate your patient immediately preceding the administration of the anesthetic.

"6. Don't overdose him through anxiety.

"7. Don't give him morphia or atropia (unless specially indicated). Pupil should not be benumbed by morphine previous to the operation.

"8. Don't forget false teeth and foreign bodies in the patient's mouth.

"9. Don't tell the relatives that there is no danger. There is always danger.

"10. Don't fail to make a physical examination of the patient yourself.

"11. Don't leave your patient too soon after anesthesia."

Bromide of Ethyl.

The usefulness of, and the indications for, the employment of ether and chloroform, I have already somewhat exhaustively discussed. They have an established sphere of indications. Yet it is my opinion, based on clinical observation, that the comfort and the safety of the patient, as well as the convenience and ease of mind of the operator, can often be promoted by using, in appropriate cases, ethyl bromid instead of chloroform or ether. Many operations do not demand the long anesthesia of ether with its attendant discomforts, nor do they warrant submitting the patient to the dangers of chloroform anesthesia. Hence, an hiatus, which in the present state of our knowledge can often be filled by the use of ethyl bromide. It is an agent well adapted to secure anesthesia for operations of short duration. It is an agent especially well adapted for use in children and young adults.

PROPERTIES OF ETHYL BROMIDE.

Ethyl bromide (chemically C_2H_5Br) is a very volatile liquid, having a very agreeable odor and a non-saccharine taste. It has a density of 1.40 and a boiling point of 40.70. It has the great advantage over nitrous oxide of portability and simplicity as regards the apparatus required for its administration. Its use requires no special apparatus. Our text-books on surgery mention the agent but fail to give the technique of its administration and fail to give it the consideration which it deserves. It is a general anesthetic, the popularity of which is increasing. It is an innocent anesthetic on condition that its inhalation is of short duration and that it is adminstered properly. If it is not administered properly, its use is unsatisfactory to the operator and dangerous to the patient.

Dr. Chisholm has used it in 3,000 cases without fatal or untoward results occurring during or after its use. Gilles collected 20,000 bromide ethylizations without a death. Reich went over the literature and found 16 deaths had occurred in 60,000 administrations. In some of these 16 cases, the anesthetic had been administered faultily, in others an impure or decomposed preparation had been used, and in a few cases, the deaths were directly traceable to the anesthetic. I have used the agent myself and have seen it used frequently in

Prof. Coulter's and Prof. Hawley's nose and throat clinics and I have never seen any ill-results from its use.

With bromide of ethyl as with other anesthetics, experience is required to be able to use it to the best advantage, and with the greatest safety to the patient. It exerts no notable influence upon the inhalant's temperature. It exerts no modifying influence on the secretions. In some individuals, its use provokes marked sweating. Its stage of excitement is of a very transient character. Owing to the fact that it does not secure complete muscular relaxation, that it does not relax muscular spasm, it is not of aid in the diagnosis of fractures and dislocations, and can not be utilized in effecting the reduction of these conditions. Outside of slightly accelerating the pulse, it has, in therapeutic doses, no special action on the heart. In toxic doses, it is a cardiac depressant. It accelerates the respirations. It has a marked depressant action on the respiration only when large and practically excessive doses are taken. Death is caused by the toxic action of the drug on the respiratory center. It is eliminated by the lungs. Owing to its great volatility, it is rapidly eliminated. "Bromide of ethyl is almost totally eliminated by the respiratory organs." (Ch. Robin.) Traces of it have been found in the renal secretion.

ADVANTAGES OF ETHYL BROMIDE AS A GENERAL ANESTHETIC.

(1) Simplicity of use. Technique of administration is easily acquired. If during the inhalation of this agent, accidents should occur, they are, owing to the great volatility and rapid elimination from the system of bromide of ethyl, rapidly recovered from.

(2) Under its use, the performance of operations upon patients in the sitting posture is permissible. This posture, though not as favorable as the recumbent posture, is not dangerous for bromethylized patients, owing to the fact that bromid of ethyl produces cerebral congestion and not cerebral anemia. This agent, unlike chloroform, is not a predisposant to syncope. With ether anesthesia, the sitting posture is undesirable; with chloroform, it is positively dangerous. The maintenance of the patient in the sitting posture is of great convenience to the operator for the performance of operations in the naso-pharynx, such as the removal of naso-pharyngeal adenoids, tonsillotomy. The patient's head and neck can, at the proper time, be rapidly thrown forward, and the blood thereby escapes through the mouth and nostrils instead of gravitating in the stomach or in the lungs, as it is prone to do when mouth or throat operations are performed with patients in the recumbent posture.

(3) The great rapidity with which anesthesia is induced. The time required to induce deep narcosis varies from 45 seconds to 2 minutes. Generally speaking one minute suffices. This saving of time is of distinct advantage in dispensary and in office work, especially when one considers that the inhalation of this drug, if it be pure and if it be employed with proper precautions, is not more dangerous than the inhalation of ether and chloroform. In fact, it is less so. An average, from 8 to 15 minutes are required to produce ether anesthesia.

(4) The great rapidity with which consciousness is recovered. The brain recovers its functions perfectly, and quickly after the deep but very transient impression brought about through the inhalation of the vapor of this potent agent. Usually after the withdrawal of the inhaler, the patient will remain unconscious from two to three minutes and will then promptly return to consciousness. After the anesthetic is removed, coordination of the muscular movements is rapidly regained. Five minutes after the anesthesia, the patient is as much himself as if no anesthetic had been administered. He can leave the office and walk home, unassisted and unattended. This feature makes this agent useful for such operations as can safely be performed in the physician's office.

(5) Absence of annoying after effects. No

shock after its use. Nausea and vomiting do occur, but are very infrequent if the drug is inhaled upon an empty stomach. If after its use vomiting occurs and persists, relieve it by having patient take a draught of ice water, or by having him swallow small pieces of ice. Frequently after its use the patient's breath for a few days has a mild garlicky odor. This is not productive of much discomfort. Bromide of ethyl is quite unirritating to the respiratory mucous membrane, hence its inhalation is never followed by bronchitis, or ether pneumonia; neither is it followed by other such unfortunate post-anesthetic complications as nephritis.

(6) The odor does not remain as does that of ether on the clothing of the operator or on that of his assistants. The odor does not permeate the office.

(7) It can be safely administered without as much pre-anesthetic preparation of the patient as is required for ether or chloroform anesthesia.

DISADVANTAGES OF ETHYL BROMIDE.

(1) It is not suitable for prolonged anesthesia. Experience has conclusively demonstrated, that its use is dangerous in operations, the performance of which requires more than a few minutes. For prolonged anesthesia, this agent possesses no advantages over ether or chloroform. It does pos-

sess additional dangers. Hence we shall employ this agent only in those operations to which it can be adapted, that is, only in operations of short duration. Even the warmest advocates of bromid of ethyl concede that it should not be used as an anesthetic for prolonged operations. "Its use should be restricted to short operations." (Gleich.)

(2) The use of bromide of ethyl is contraindicated in individuals having serious cardiac, renal or pulmonary lesions. Alcoholics are not favorable subjects for bromethylization.

(3) It does not secure complete muscular relaxation. "Bromide of ethyl, as it often causes muscular rigidity, should not be used in operations in which relaxation of the muscles would be of assistance." (Dudley Buxton.)

(4) It is easily decomposed by exposure to light and air.

(5) Like ether and chloroform, its use requires an experienced assistant whose whole attention must be given to the administration of the anesthetic. Local anesthetics enable the operator to dispense with this assistant.

Bromide of ethyl general surgical anesthesia (this agent is also employed by a few as a local anesthetic) can be resorted to for operations such as the following: Opening of superficial abscesses, as abscesses of the abdominal wall; dilation of the sphincter ani; hemorrhoidal operations; removal

of urethral polypi; internal urethrotomy; curetting of sinuses; tenotomy; scraping of carbuncles; removal of aural polypi and paracentesis of the tympanum; ablation of condylomata, etc. Any painful surgical operation, the performance of which does not occupy more than two minutes, can be safely and painlessly performed under bromid of ethyl. The agent is particularly adapted for children while subjecting them to short examinations involving pain.

PROPER TECHNIQUE OF ADMINISTRATION.

(1) Do not employ this agent in cases unsuited for its action, for instance, as for major operations lasting more than a few minutes. Its usefulness for long operations is no longer debatable, it is established. Fatalities have resulted from its employment in prolonged operations. You would not employ chloral hydrate for the palliation of acute pain, you would employ opium or one of its derivatives; so for prolonged operations requiring general surgical anesthesia, you will not employ bromid of ethyl, you will employ either chloroform or ether.

(2) Make a physical examination of your patient. The object is to determine whether there are contra-indications to the use of this particular anesthetic. Serious cardiac, pulmonary and renal diseases are conditions that make the use of this

agent, as well as that of general anesthetics, hazardous. In alcoholics, bromide of ethyl provokes a marked stage of excitement.

(3) Always be sure that the bromide of ethyl that you are going to use is pure; be sure that it has not undergone decomposition. Impurities may come from the process of manufacture or may come from decomposition. Exposure to air and light rapidly decomposes this agent and results in the formation of compounds having a more toxic effect than ethyl bromid. If you use one-half ounce vials, after the vial has been used to anesthetize one patient, throw away the unused portion of the contents. This is not extravagance; it is prudence. "Most of the unfavorable symptoms, such as vomiting, are due not to the bromide of ethyl, but to the impurities too often found associated with it." (Bazy.) Pure bromide of ethyl has a perfectly neutral reaction with reference to litmus paper. It is colorless. If it be yellowish, it is decomposed and contains free bromine. This latter element is a distinct irritant to the respiratory mucous membranes. As the liquids is very easily decomposed, buy it in small colored-glass vials of one-half or one ounce. The vials are sealed by melting the glass neck in the flame.

(4) Never use bromide of ethylene instead of bromide of ethyl. These substances are dissimilar

compounds. The former is chemically represented by $C_2H_4Br_2$; the latter, by C_2H_5Br. Bromide of ethylene is not only a poor anesthetic, but it is also a very dangerous agent. It has caused deaths.

(5) The drug is to be inhaled upon an empty stomach. When practicable the taking of solid food should be avoided by the patient for four hours, and liquid food for three hours, before the administration. If the drug is inhaled upon a full stomach, nausea and vomiting are apt to follow its use. The most opportune time for the induction of general anesthesia is when the patient is rested and when his stomach is empty.

(6) Have the patient urinate previous to starting the anesthesia. This lessens the liability to involuntary emission of urine during anesthesia. This accident, when it occurs, is always very embarrassing, especially so in female patients.

(7) In the absence of a special indication for the employment of any other position, the recumbent posture, with slight elevation of the head, is the posture of election. It is more convenient for the operator; it is safer for the patient. If the patient be a child, and the operation be one in the buccal cavity, demanding that anesthesia be secured with the patient in the sitting posture, wrap a sheet around the patient's neck and chest so as to include and prevent the movement of the

arms. The child is then taken upon the nurse's lap, its legs being placed and immobilized between the nurse's thighs. The nurse's left arm encircles the child's chest to prevent struggling and movements of arms, and her right hand immobilizes the child's head on her right shoulder. This is same position that is employed for the intubation of children.

(8) All constrictions about the neck, the chest or the abdomen are to be removed. The corset is to be removed. The same applies to any other agency interfering with the respiratory movements. Free respiration hastens the production of anesthesia and also facilitates, once the inhaler is withdrawn, the elimination from the body of the ethyl bromid inhaled. The innocuousness of this agent is largely due to its great volatility and to its rapid elimination from the system. Interference with the patient's respiratory movements is not uncommonly due to a lazy assistant using the patient's chest as an arm rest.

(9) All foreign bodies, such as chewing gum, false teeth, etc., are to be removed from the mouth. If the operation is to be performed in the buccal, the naso-pharyngeal or the laryngeal cavities, previous to starting the anesthetic insert carefully and gently a mouth gag with padded alveolar projections between the patient's left upper and lower

molars. With bromethylization, there is often mild trismus.

(10) Leave eyes uncovered and watch them. When analgesia begins to appear, the pupils dilate and the conjunctival vessels become appreciably congested. The anesthetist is to watch the anesthesia only,—the operator is to watch the operation.

(11) The inhaler to be used can be made by folding a crash towel into an air-tight cone. The cone is made almost impervious to air by placing a layer of paper between the folds of the towel. The base of the cone must be large enough to cover both mouth and nose. Hold the rim of the cone firmly down upon the face so that very little air can enter. The use of a cumbersome apparatus for the administration of this anesthetic has no advantage over that of a cone made of paper and gauze, or with paper and a towel. These cumbersome apparatus are not as portable, are costly, and are not as cleanly as the towel and paper cone; neither are they as safe. A fresh cone is to be used for each anesthesia.

(12) Operator must be prepared to operate as soon as narcosis is complete. He must not wait for complete muscular relaxation. Every preparation should have been made in advance. Instruments should have been sterilized and arranged in the order in which they are to be used.

Surgeon must be dextrous and thoroughly familiar with the different steps of the operation which he is to perform. No time must be lost, as bromide of ethyl anesthesia is a rapidly fleeting anesthesia. The effects of it pass off too quickly to make it of any service to slow operators or for tedious operations.

(13) Instruct the patient in advance to make deep and long inspirations. A few inhalations suffice. The entire dose of anesthetic is to be given at once. Keep in mind that bromide of ethyl is not chloroform, and that it must not be administered like chloroform. Chloroform must be administered by the drop method, cautiously and slowly; ethyl bromide must be administered in massive doses, rapidly and, in fact, brutally. Unless bromide of ethyl vapor is crowded, only a state of semi-anesthesia must be expected. Push the bromide of ethyl during the few moments necessary to produce anesthesia. Ethyl bromide, unlike chloroform, should never be used with an admixture of air. The admission of air retards and may prevent the production of narcosis. A saturated ethyl vapor must be inhaled to the exclusion of atmospheric air, in order to obtain narcosis speedily and effectually.

The entire dose for a child is about two drams, for an adult from 4 to 5 drachms (as much as six drams can be used). It is poured at once

into the inhaler. "I pour the full dose required to produce anesthesia into the inhaler, the dose in children ranging from one and a half to two and a half drachms, and in adults from two to three drachms. I immediately cover the patient's nose and mouth, having previously instructed the patient to breathe deeply." (Kempster.) Apply cone firmly and closely to mouth and nose and do not remoove it until anesthesia is induced. Owing to the great volatility of the substance (it is the most volatile of the general anesthetics) the removal of the cone retards the production of anesthesia. If the cone is held at a distance from the face and given with free admission of air to the space between the towel and face, satisfactory anesthesia will not be obtained. Once full anesthesia has been induced and the cone has been withdrawn, most authorities condemn its being applied to the face again.

The first few inhalations give rise to a very decided flushing of the face. In alcoholics, there is a short period of excitement. The agent often provokes muscular spasms. Do not be alarmed by the presence of muscular rigidity, it will soon disappear. The same stage of muscular rigidity occurs during the administration of other general anesthetics. The patient struggles violently and, to the uninitiated, appears to be in danger of asphyxia, nevertheless, the cone must not be re-

moved until full anesthesia is induced and the struggling has ceased. The stoppage of all struggling, the absence of the conjuctival reflex, the falling down limply of the elevated arm, are all evidences that inform you that your patient is sufficiently anesthetized.

In case of failure of respiration occurring in a patient inhaling bromide of ethyl, immediately place the patient in the recumbent posture and proceed to perform artificial respiration. Always begin with the act of expiration; inspiration would promote further absorption of the anesthetic.

For the performance of artificial respiration in the combating of some of the accidents incident to general anesthesia, we employ either Sylvester or Laborde's method. Both methods can be employed simultaneously.

CHAPTER II.

LOCAL ANESTHESIA.

"To perform operations under general anesthesia when they are certainly practicable with one or another form of local anesthesia, I must, from the standpoint of humanity, denounce as absolutely unjustifiable."—Schleich.

Local anesthetics are employed to abolish, by their topical application, the sensibility of a part for more or less prolonged periods, during diagnostic, therapeutic and operative procedures of various kinds. The number of substances that have been proposed and used as local anesthetic agents is great. Very few have found wide acceptance. Very few have remained popular for any length of time. A local anesthetic, to be ideal, must meet the following requirements:

1. Complete abolition of pain.
2. Non-interference with the operator's procedures. That is, the operator should not be compelled to modify his operation on account of restrictions imposed by the local anesthetic agent.
3. Production of no unpleasant after-effects, either local or general.
4. Non-interference with the healing process.

We have yet no agent that always meets these requirements.

Among the less used agents may be mentioned:

(a) Brucine in five per cent solution. This agent was abandoned because it did not give uniform results; it was not readily absorbed, and had none of the advantages of cocaine.

(b) Beta-Eucaine is a good local anesthetic serviceable for all operations upon the ophthalmic, urethral, buccal or other mucosae. It can also be used intra and hypodermically. It is said to cause, in therapeutic doses, no heart depression or other unpleasant systemic effects. It is less toxic than cocaine with almost equal analgesic power, and can therefore be employed in larger amounts and with greater freedom, in such cases where the field of operation is extensive.

It is a colorless, crystalline powder, soluble in 30 to 33 1-3 parts of cold water, making a 3 per cent to 3½ per cent solution. Stronger solutions may be made with the aid of heat. The eucaine crystals that are deposited on cooling may be redissolved by raising the temperature of the solution, without in any way influencing its efficacy. It is 3.75 times less toxic than cocaine; it is at times irritating to the tissues; its injection into the tissues also at times causing pain; it causes a hyperemia of the tissues, the increased hemorrhage attending its use obscuring to a certain extent the field of operation. It admits of complete sterilization by boiling. This is a matter of

much importance, as complete asepsis, is essential for the successful performance of surgical procedures. Beta-eucaine is a stable compound. Its solutions keep for an indefinite time without undergoing decomposition. The solution of beta-eucaine can be frequently boiled without injury and without losing its anesthetic properties. It has no action on the pupil, on accommodation, or on eye tension. One reason for the similarity of analgetic action existing between eucaine and cocaine is, according to Braun, that their osmotic tension is the same. The anesthesia produced by it is of longer induction and of shorter duration than that induced by cocaine. "Being 3.75 times less toxic than cocaine, it has the advantages in stomatology that the patient need not lie down during the operation; that he can go away at once; and that none of the difficulties that sometimes follow the use of cocaine occur. It should therefore, in this department, be preferred to the latter drug. In general surgery of the minor kind, cocaine is to be preferred because it is safe when prudently administered, and is free from some of the inconveniences of eucaine." (Chapiro.) The following solutions are used:

For ophthalmic purposes, in 2% to 3%. (Most Chicago oculists prefer cocaine for ophthalmic work.)

For dental and general surgical use, 2% to 3%

solution. Many surgeons, however, use a 5% solution for hypodermic use.

For examinations, as of the larynx, of the urethra or of the bladder, 1% to 3% solution.

For operations in the nasal fossae, in the nasopharynx, and in the larynx, a 4% to 5% solution is required to secure satisfactory anesthesia.

For the alleviation of painful deglutition associated with laryngeal tuberculosis, a 5% spray of Beta-Eucaine can be used in the larynx.

For infiltration anesthesia, Braun's formula is used. It admits of sterilization by boiling.

Beta-Eucaine	0.1
Sodium Chloride.....	0.8
Aquae distillatae.....100.	

For the production of beta-eucaine anesthesia, the technique employed in the induction of cocaine local anesthesia meets the indications. If Braun's formula is used to induce infiltration anesthesia, employ the technique that I follow with Schleich's solutions.

The following is quoted from Gerald Dalton, and will give some idea of the applications of beta-eucaine.

"Anesthetizing the urethra in conditions where the passing of sounds, catheters, urethroscopic tubes, etc., cause more pain than is desirable. The anterior urethra is injected with 1 dram of a 3% solution of beta-eucaine, injected by means

of an ordinary small urethral syringe, the glans penis being held tightly up against the nozzle so that no fluid may run out of the urethra. The solution is kept in the passage five to ten minutes; when it is let out, the anterior urethra will be found anesthetized quite sufficiently to permit the passage of even large instruments without pain. If it is required to introduce instruments into the prostatic portion or bladder, after allowing the solution to run out of the anterior urethra, 20 minims of a 3% solution should be injected into the prostatic urethra by the prostatic instillator, and the instrument withdrawn; the solution being retained by the compressor urethræ muscles. A pause of four to five minutes more will be necessary, when the posterior urethra will also be found insensitive to pain. The anesthesia lasts for a period varying from five to twenty minutes.

"Circumcision.—The foreskin and glans having been cleansed in the ordinary way, 1 dram of a 5% solution of eucaine is injected with the ordinary urethral syringe under the foreskin, which is drawn well forward (when possible); the syringe is slipped out, the solution being kept in between the glans penis and prepuce by tightly holding the end of the latter (this can usually be done by the patient himself). A hypodermic syringe is then charged with a 3% normal saline solution of eucaine. Commencing near the frenum, small

blebs of solution are made just under the skin, each bleb, of about 2 minims, touching its neighbor. A ring is thus made under the line of incision. When this is finished, about six to eight deep injections are made into the subcutaneous tissue, with perhaps one or two extra ones near the frenum. The solution retained under the foreskin is now allowed to run ont, the parts are cleaned, and the operation is begun at once. Bichloride of mercury solution should not be used, but carbolic acid, or chinosol, etc., may be employed. The operation will probably not be absolutely painless; but the pain will be so slight that it is perfectly bearable even by a highly nervous patient.

"Buboes.—In opening and curetting suppurating buboes in the groin or elsewhere, the parts having been cleaned, a 3% solution is injected under the skin in the line of incision, as for circumcision; five or six deeper injections are made into the tissues beneath. Both in this operation and in the one for circumcision, 40 to 80 minims may be used. The incision is made at once; it is not necessary to wait ten minutes, as sometimes stated, after the hypodermic injection; since absorption from a mucous membrane by contact takes place less rapidly. After evacuating the pus, a 5% solution is poured into the wound, or pledgets of cotton soaked in solution are packed into the cavity; a delay of a few minutes is made when

curetting may be lightly performed painlessly. One dram of solution may be used for this with safety. Occasionally the skin over the bubo is so inflamed and tender that even the prick of the needle is dreaded by some patients. This may be obviated by previously spraying with ethyl chloride.

"Hydrocele.—The hydrocele is tapped, and the fluid withdrawn. One drachm of a 3% solution is injected into the sac through the trocar. Iodine may then be injected in the usual way. The patient only complains of a "warm sensation," instead of severe pain usually experienced. There is no after-pain."

(c) Guaiacol dissolved in olive oil has been used as a local anesthetic. Guaiacol is intensely irritating and is insoluble in water. It has not met with general favor. It is still used in selected cases by its introducer, Lucas-Championniere, and his personal admirers; it does not produce anesthesia as rapidly as cocaine or the infiltration method; it can, by its vaso-constrictive action, cause sphacelus; it does not always procure anesthesia; there is much smarting at the periphery of the area into which the fluid is injected, and this smarting lasts longer than the anesthesia.

(d) Carbolic acid is employed as a local anesthetic. It exerts a destructive and caustic action on the tissues. It does not penetrate deeply.

Antipyrin is valuable to obtain anesthesia of the urinary bladder. Its anesthetic power is less than that of cocaine, but it has the advantage of being less toxic. Surgical local anesthesia can be induced by the aforenamed and other less valuable agents. It is neither necessary nor practical for the medical practitioner to have a thorough and complete knowledge of every agent that can induce local anesthesia. It is far wiser and of far more utility for him to confine himself to the use of those local anesthetic agents, the value of which is universally acknowledged and to master thoroughly the technique of their administration. Experimentation is legitimate and commendable when carried on in laboratories and in large public hospitals by experienced men. Private patients, however, pay to be healed, not to be immolated on the altar of science, hence the busy general practitioner must accept the teachings of, and adopt the methods sanctioned and employed by the specialist.

Local anesthesia is nowadays generally induced by one of the following methods:

(1) Refrigeration—(a) cold; (b) evaporation of ether; (c) ethyl chloride, etc., etc.

(2) The use of Cocaine and Eucaine B.—(a) applied superficially to mucous membranes; (b) injected subcutaneously; (c) with the cataphoric action of the galvanic current. Cocaine is the

most effective of our local aneshtetic agents. Its toxicity is its drawback.

(3) The infiltration method.—The principle being to infiltrate the entire field of operation with fluid as indifferent as possible to the organism. To obtain a complete anesthesia with an infiltrating fluid, the entire area must be tensely infiltrated. The effect appears immediately after the injection.

In using cocaine, eucaine, and the infiltration method of anesthesia, an elastic bandage should be applied whenever possible, even about the scalp. Care should be taken not to apply it too tightly, and also that it be loosened gradually after the operation is well over.

Local anesthetics in the present state of our knowledge can not entirely displace general anesthetics. General surgical anesthesia and local surgical anesthesia have each their respective indications and limitations, each their respective advantages and disadvantages.

ADVANTAGES OF LOCAL OVER GENERAL ANESTHETICS.

The advantages which local anesthetics possess over general anesthetics are:

1. Minor operations with local anesthesia can be performed without assistants. This is a matter of importance to the country practitioner who can not as easily obtain skilled assistants as his city brethren. This is also important when there are

no means with which to compensate an assistant. The giving of a general anesthetic involves a great expenditure of energy and the assuming of a great responsibility, and it is unkind to ask a fellow-practitioner to give a general anesthetic for a mere "thank you."

2. Greater rapidity of action. Their use does not entail the loss of time incident to putting patient under the influence of a general anesthetic.

3. Headache, nausea, vomiting, etc., do not follow their use. Annoying after-effects are exceptional.

4. Their use does not give rise to any serious after effects. Nephritis, pulmonary inflammations, paralysis and other pathological states have occurred consequent to the inhalation of general anesthetics.

5. General anesthesia is always accompanied by more or less depression or shock. After minor operations, under general anesthesia, the shock or depression is often due to the ether or chloroform administered. General anesthetics are depressants. In debilitated patients, they lower the general vitality, they lower the patient's natural resistance to disease. In laryngeal diphtheria necessitating the performance of tracheotomy, avoid the depressing effects of general anesthetics by the use of local anesthesia. "Extreme prostration and asphyxia from diphtheritic poisoning are absolute

contra-indications to the use of Chloroform in tracheotomy." (Geffrier.) Fraenkel reports twenty-three cases of tracheotomies performed successfully under cocaine anesthesia. Lennox Brown reports forty.

In Prof. Schleich's clinic, infiltration anesthesia has been used with success in tracheotomies performed for the relief of dyspnea due to chronic stenosis and to acute diphtheritic stenosis.

6. There is a mortality inherent to the use of general surgical anesthesia. The dangers of general anesthesia are, however, dependent more on the experience and competence of the anesthetist than on the drug itself. Skilled anesthetists rarely have fatalities. Lawrie of India reports 45,000 chloroformizations with no death. The mortality of local anesthetics, when cautiously used, is practically nil. They can be used when the patient is too ill to take a general anesthetic with safety. In cases where there are grave objections to the employment of general anesthesia, major operations can be performed under local anesthesia. Amputation of the thigh has been successfully done under cocaine anesthesia.

With general anesthesia the operator has to work in a constrained position. This is not the case with local anesthesia.

8. Local anesthetics do away with the apprehension and fear which most people have against

being put to sleep with a general anesthetic. Their use meets less objection on the part of patients. Consent to their use is more easily obtained. Hence, surgical interventions can be more timely, more opportune. Patients are not so afraid of local anesthesia as they are of general anesthesia. While they are thinking over the advisability of taking a general anesthetic, the pathological processes progress.

9. The technique of their administration is comparatively simple. No previous preparation of the patient is required. In operations about the face, throat and nose, any apparatus used (Souchon's excepted) to produce general anesthesia embarrasses the operator, interferes with his operative manipulations.

10. The operator does not lose patient's co-operation and guidance. The patient remaining conscious, operations about the oral cavity under local anesthesia are not attended with the danger of deglutition of blood, of aspiration of blood and foreign bodies as teeth, etc., into the respiratory passages. The patient can be of aid to the surgeon by opening his mouth, thus doing away with the use of the mouth gag to maintain jaws apart, can expectorate any blood accumulating in mouth. The patient being conscious, there is no danger of the tongue falling backward, occluding the glottis and causing asphyxia, no danger of a tooth or

foreign body being swallowed. In operations on hands or feet in which cut tendons have been sutured, when one wishes to find out whether the ends have been correctly adjusted, voluntary motion supplies at once the physiological test.

11. Local anesthetics do away with the retching and vomiting that so often accompany the induction of general anesthesia. This retching and vomiting are especially objectionable in operations about the face, mouth, throat and eyes.

12. Local anesthetics are more agreeable to the patient, are safer than general anesthetics. The comfort and safety of the patient should ever be present to the physician's mind. Hence, we always employ local anesthetics instead of general anesthetics when the temperament of the patient and the nature of the operation render their use practicable.

WHEN NOT TO BE USED.

Local anesthetics must not be resorted to in the presence of insurmountable fear felt by the patient; of hysteria; or against his personally expressed wish to take a general anesthetic; when they would fail to secure a sufficiently deep anesthesia; when, in operations requiring exposure, a general anesthetic might be preferred on sentimental grounds; where muscular relaxation is required, as in the reduction of fractures and of dislocations, as in intra-abdominal operations; when very exten-

sive dissection is necessary, as in the separation of abdominal adhesions in surgery. (Abbe.) It must not be resorted to in operations where one does not know beforehand how extensive the necessary operative procedures will be. Many a surgeon has been obliged to finish an unexpectedly extensive dissection upon a groaning, screaming patient, because he had already reached the limit of safety in the use of his local anesthetic agent, or because he found a further extension of the local anesthesia impracticable for one reason or another.

Neither should they be resorted to in the case of very nervous individuals or in children, because they are liable to become unruly on seeing the knife, making local anesthesia often insufficient and very unsatisfactory. "Children, for instance, appear to be unsuitable subjects for this procedure. The mere sight of the surgical preparations for operation frightens them, and their unstable emotional condition is upset by the slightest pain. Very timid adults for the same reason are also better with general anesthesia." (Barker.) Nor should they be used in major operations attended by much hemorrhage, since the consciousness of the patient in these conditions is annoying to the operator, nor when the employment of a local anesthetic would impair the vitality of the tissues.

Local anesthetics will be found very serviceable and preferable to general narcosis in all operations

simple in technique which do not take up much time and where every step is well known. Operations such as the following come within the domain of local anesthesia:

Abdominal and thoracic puncture; incision and evacuation of abscesses when located near the surface; operations on felons, carbuncles, naevi, sebaceous cysts; lipomata; adenomata of breast when near surface; circumcisions; castrations; and many operations in ophthalmology, laryngology and rhinology.

HOW TO PROCEED.

It is well, however, to bear in mind that the anesthesia obtained by the use of local anesthetics is not as complete as that obtained by the use of general anesthetics. Consciousness being present, the perception of pain is not as completely abolished as with general anesthetics. Many individuals, however, will prefer to endure a slight amount of pain rather than be put to sleep.

The induction of local surgical anesthesia should only be practiced by qualified and responsible persons, that is, by dentists and by physicians. Irrational employment of local anesthetics leads to deleterious results. The toxicity of the agents employed and the serious consequences that can follow their unscientific use amply justify the dictum at the beginning of this paragraph.

When about to induce local anesthesia, and to operate under it, whatever may be the agent used, cover the patient's face with a light fabric so as to completely close off the field of operation from his observation. The sight of surgical instruments, of the operator's movements, of blood, will in some patients induce syncope. The patient seeing or being aware that an operation is being done upon him, the apprehension which is so commonly felt that pain will be experienced, in many cases, produce faintness and in some instances fatal syncope.

Always tell the patient that there will be a slight amount of pain; he will then not be surprised is he experiences a little pain and, being forewarned, will not become alarmed. Section or rough manipulation of muscle tissue causes dull pain of an aching character which can easily be endured. (Lilienthal.) Section or manipulation of tendons is not felt. Manipulation of nerves causes a pain which is acute, if nerve is grasped with clamp or caught in a ligature. (Lilienthal.) Ligature of arteries is painful. Vaso-motor nerves are sensitive. (Wyeth.)

ANESTHESIA BY REFRIGERATION.

Cold benumbs the nerve-endings or trunks. The freezing methods are of limited application because (a) cold not penetrating beyond a very shallow depth, this method of anesthesia suffices

only for short surface operations; (b) they can be applied only to limited areas; there is danger of gangrene of the frozen tissues; (c) freezing retards healing; (d) anesthesia produced by the refrigerating methods is evanescent; its induction is attended with pain, especially in inflamed parts; the pain following its disappearance is at times very severe; (e) freezing substances harden the tissue and alter the appearances of cut surfaces, making it difficult to differentiate between normal and pathological states of tissues. (Lilienthal.) (f) Their use in certain tissues, as on the scrotum, may produce a slough.

Chopped ice and salt are used. Dr. Lemke uses these to anesthetize the site of insertion of the canula, previous to injecting nitrogen gas in tubercular pulmonary cavities. Rub over the part to be incised a small muslin bag containing some ice pounded very fine, and salt. This is to be kept up for two or three minutes, or until the skin is blanched.

Sprays of solutions, of which the following is a fair example, are extensively employed:

Chloroform	parts 10
Ether	parts 15
Menthol	part 1

This solution quite freezes the part in about a minute. The skin becomes white and hard. The freezing process must not be carried too far, other-

wise a slough is apt to ensue. The anesthesia produced by this spray lasts from two to six minutes. The solution and all others containing ether, must not be used in operations about the eye. Ether vapor irritates the cornea and conjunctiva.

Ethyl Chloride (that of French manufacture is the best) is of use to anesthetize very superficial parts, as when a mere incision is to be made in the skin. It is useful in the opening of abscesses and felons. It is useful in the removal of warts, both simple and venereal, and in the extraction of foreign bodies. If too much pressure is not made, that is, if the knife is sharp, operations under ethyl-chloride anesthesia are practically painless. It is usually dispensed in large glass tubes, which contain enough ethyl chloride to produce anesthesia in at least a dozen cases. The heat of the hand causes the liquefied gas to issue in spray form. In order to produce local anesthesia, the bulb of the tube is held in the palm of the surgeon's hand. The cap is unscrewed and the jet of spray is directed to the spot that is to be anesthetized. Hold tube at a distance of from six to ten inches from the part to be anesthetized. The part soon becomes frozen and ready for operation. Do not operate before the part has assumed a parchment-white color. This white color is indicative of local refrigeration, is indicative of loss

of dermal sensation in frozen area. It is a good rapid local anesthetic, having no influence on the sensory nerve centers in the brain. Anesthesia is induced in less than a minute and lasts about two minutes. This substance is highly inflammable, and when it is used, operations must be done at a good distance from gas or other flame. The exact limits of the operations must be determined beforehand, because the ethyl chloride hardens the skin. In many operations constriction of a member may be practiced before applying the spray. This, by limitation of the warm blood supply, will effect a more rapid and lasting anesthesia. After using the spray, the cap must be screwed on tightly, as the extreme volatility of this substance will cause its escape from the tube if the screw cap is loosely adjusted.

Previous to using the ethyl chloride spray, the field of operation must be sterilized. The bulb of ethyl chloride must be held with sterile gauze so that the surgeon will not contaminate his hands.

COCAINE.

Cocaine is to the rhinologist, laryngologist and ophthalmologist what chloroform and ether are to the general surgeon. For the ophthalmologist, cocaine meets every requirement that could reasonably be expected from a local anesthetic. It has caused a few deaths. So has opium, so has

belladonna, and so have many other valuable medicinal agents. These few fatalities should not lead us to abandon the use of cocaine, but should stimulate us to discover and observe methods of administration that do away with some of the uncertainties attending its use. Careful attention to the teachings of experimental therapeutics and close observation of the methods practiced by eminent clinicians, minimize the dangers incident to therapeutic procedures and enhance their value to humanity. Cocaine is an agent of great power and usefulness, but it must be used with caution. In the absence of positive contra-indications to the use of general anesthesia, it should not be used in irregular and prolonged operations, as in abdominal surgery. The quantity required to maintain prolonged anesthesia is toxic. Neither should it be used in individuals showing organic disease of the brain, heart, lungs or kidneys, when local anesthesia by refrigeration, by infiltration or by the use of such agents as antipyrin, orthoform or strophantheine meets the indications.

PROPERTIES OF COCAINE.

Cocaine paralyzes the terminal filaments of the peripheral sensory nerves when brought in contact with them. Its use as a local anesthetic is based upon this property. The less vascular the part the more intense its action. It possesses remarkable

anesthetic properties upon mucous membranes. All mucous membranes are amenable to its anesthetic properties. A canal lined with mucous membrane may be rendered insensitive by injecting into it a small amount of cocaine solution. The conjunctival, the labial, the nasal, the pharyngeal, the gastric, the urethral, the vesical, the rectal, the vaginal and the uterine mucous membranes are all anesthetized by the application of cocaine to them. The application to any of these membranes of swabs of cotton saturated with a solution of cocaine is followed by insensibility in from three to five minutes. The cocaine solution can be brushed upon the field of operation. This loss of sensation continues for from fifteen to twenty minutes. The influence of cocaine solutions on mucous membranes depends entirely upon the strength of the solution, the frequency of the applications and the time that has elapsed from the time of first application. A 2% solution is almost always sufficiently strong to obtain anesthesia of mucous membranes for minor operations. The statement made by some that a 2% solution is more effective than a stronger solution is erroneous. To secure anesthesia in throat, nose, larynx, do not use the spray. Spraying, be it ever so skillfully done, will not prove as satisfactory as a properly shaped and carefully applied cotton pledget.

Applied to the unbroken skin, cocaine does not anesthetize it. To anesthetize the skin the cocaine solution must be injected in the dermal tissues; that is, in the skin and not beneath it. Injections must be intradermic and not hypodermic. There is a difference in the susceptibility of patients to cocaine, also a difference in the susceptibility of the same patient on different occasions. There are individual idiosyncrasies. Children appear to come more quickly under the influence of the drug than adults. The application of cocaine to the conjunctival, vaginal and rectal mucous membranes is almost never followed by alarming symptoms. Serious accidents have followed, however, its application to the urethral mucous membrane. Its subcutaneous use has given rise to a few accidents. In vascular regions, such as face, scalp, nasal fossæ and mouth, large quantities of cocaine solution must not be used. Reclus collected from the medical literature, and analyzed, sixteen deaths due to cocaine anesthesia. He says that all these deaths were due to one or more of the following conditions:

(1) The use of too strong solutions.

(2) Sudden emptying of large quantities of the drug into the general circulation, either by puncture of a vein or injection into areas vascular, by virtue of the presence of an inflammation or naturally so, as is the case with the head.

(3) Operating in the erect position was a factor in all the cases.

"The healing process is not impaired by the use of cocaine." (Ludwig Pernice.) "In my experience, wounds made under the influence of cocaine have invariably healed well." (W. Moore.)

These opinions are in accord with the experience of all those that have used cocaine extensively.

The application of cocaine to mucous surfaces is attended by a weakening of the reflexes, so that parts can be handled that without the influence of cocaine could not be handled. Insensibility follows its application to mucous membranes in from three to five minutes, and lasts about ten minutes.

For cocaine anesthesia use the hydrochlorate of cocaine, the alkaloid itself is very insoluble in water; other preparations do not possess the same anesthetic properties. (Franz Fux.) Cocaine phenate, being insoluble in water, is unsuited for hypodermic use. In making ointments, cocaine, the alkaloid is used, as it is soluble in fats, whereas its salts are not.

COCAINE IN OPHTHALMOLOGY.

Cocaine is of especial service to the ophthalmologist, as it does not cause phenomena of irritation. (Koller.)

In ophthalmology it is used to control pain in

the eye, in the removal of foreign bodies present in the conjunctival sac or imbedded in the cornea, and in such operations as iridectomy, cataract removal, sclerotomy, extirpation of eyeball, cure of strabismus, etc. Slitting of canaliculi and other operations on lachrymal ducts are, with its use, done painlessly. The same applies to ablation of small tumors, as cysts, to removal of pterygium, etc. Cocaine does not possess the disadvantage of producing the enormous engorgement of the ocular vessels that ether does. An objection to the use of general anesthesia in ophthalmology is the possibility of vomiting which may occur during or after the administration of a general anesthetic. This is always dangerous after a cataract operation. Vomiting by causing a too rapid escape of the aqueous humor may cause extensive prolapse of iris, subluxation of lens, prolapse of the vitreous humor, intraocular hemorrhage. The use of cocaine anesthesia eliminates the danger of vomiting. Under local anesthesia, the patient can direct the movements of his eyes according to the necessities of the operation. This is impossible under general anesthesia.

Holtz (Chicago) uses a 2% cocaine solution to anesthetize corneal ulcers previous to cauterizing them. For most operations, ophthalmologists employ solutions varying from 3% to 5% in strength. A few drops of this solution are injected

several times into the conjunctival sac, at intervals of few minutes. For enucleation of the eyeball, J. A. White says: "A solution of from 10% to 20% is required to deaden the sensibility of deep tissues surrounding the optic and ciliary nerves." About five minutes before the division of these deep tissues inject in them, by means of a syringe with a long canula, five min. of the cocaine solution. Cocaine solutions can be injected into the substance of the eyeball if necessary. If the performance of the operation is delayed ten or fifteen minutes after the first instillation, for the drug to pass through the cornea, the iris will be completely anesthetized and iridectomy can be performed without pain." (A. Duane.) Solutions of atropine, eserine, or cocaine, when applied to the surface of the conjunctiva, by a process of endosmosis, soak through the cornea and become diffused in the aqueous humor; they are thus brought in actual contact with the iris.

In making subconjunctival injections of cocaine, the episclera must not be wounded. A 1% solution is a safe solution for that purpose.

COCAINE ABOUT THE MOUTH, NOSE, ETC.

An objection to the use of general anesthetics in operations about the mouth, nose, larynx, is that voluntary cough can not take place until the patient has recovered from the effect of the general

anesthetic. During this period accumulation of blood in the main air-passages may cause asphyxia. This danger is not present when local anesthesia is used.

The use of cocaine spray to produce nasal pharyngeal or laryngeal anesthesia is to be condemned because too much unnecessary surface is anesthetized and too much cocaine is absorbed, it being not possible to regulate the dose. To anesthetize pharyngeal, laryngeal and nasal mucous membranes many operators use strong solutions ranging from 10% to 20%; most operators, however, use 4% to 5% solution first. The saliva and mucus are wiped off from the surface, as they dilute and retard the production of the anesthesia. Should, during any operations under cocaine anesthesia, sensibility of part anesthetized return, more cocaine solution must be applied to the tissues, it being remembered that, once a tissue has been brought under the influence of cocaine, it is very quick to respond to subsequent applications during the entire duration of the operation. Use cocaine in tonsilotomy, especially if both tonsils are to be cut. The patient not experiencing any pain when the first tonsil is cut, willingly submits to the excision of the second. By the application of cocaine to the surface of the tonsils, anesthesia of the deeper parts is not obtained. This however,

is not a great drawback, as the chief seat of pain, in section of the tonsils, is the mucosa.

For the removal of naso-pharyngeal adenoids in adolescents and in adults for the removal of polypi and of multiple papillomata of the larynx, cocaine anesthesia is serviceable. When cauterizing or applying caustics to diseased portions of larynx see that cocainization is complete; have a cotton wad firmly wound around the end of a probe so that it won't detach itself, and after moistening in cocaine solution, under guidance of a mirror, rub vigorously against the laryngeal mucosa.

COCAINE IN NASAL SURGERY.

In nasal surgery, cocaine is a favorite anesthetic. When used the head can be kept in proper position for illumination of part. Every step of the operation can be seen. Under general anesthesia this can not be done. It is useful to the rhinologist for the removal of deep as well as superficial tissue abnormalities, by promoting quiet, by lessening hemorrhage, by preventing secretion and sneezing. By its contractile effect on the erectile tissues, the employment of cutting instruments in the nares is facilitated and the operator is enabled to examine the field of operation easily. The removal of pedunculated growths, of excrescences of the nasal septum and other similar operations come within the province of cocaine anesthesia.

In order to anesthetize the nasal mucous membrane put in the nostril to be anesthetized a pledget of cotton saturated with cocaine solution. The pledget must be large enough to occlude the nostrils; every two or three minutes until the part is fully anesthetized instill a few drops of solution on cotton in situ. The pledget of cotton must be in contact with the area to be anesthetized for about five minutes. In using cocaine in nasal surgery, be watchful. Owing to the fact that the mucous membrane covering the turbinated bones of the nose absorbs this agent with great rapidity, accidents are liable to follow its use in this region. Joseph S. Gibb recommends general anesthesia in the following intranasal operations:

(1) Major operations involving considerable dissection.

(2) Large bony deflections requiring breaking the septum at its base.

(3) Removal of large bony spurs.

(4) Congenital or acquired stenosis.

(5) Plastic operations.

COCAINE IN OTOLOGY.

Cocaine is of service to the otologist in the following conditions:

(1) Application of painful remedies, such as nitrate of silver, alcohol, etc., in case of chronic purulent otitis, can be made to the ear after

eocainization, with little, if any, pain being experieneed by the patient. (2) Operations on the walls of ear eanal, auriele and its surroundings, such as removal of small tumors, incisions into the skin, can be rendered painless by injections of cocaine. (3) Manipulations, such as scraping, torsion, avulsion, ecrasement, etc., in tympanie eavity can be performed painlessly under loeal anesthesia when the drumhead is perforated. (4) The following otological operations ean be performed under loeal anesthesia: Paraccntesis of tympanum, incision of its anterior and posterior flods; tenotomy of the tensor muscle, section of the handle of the malleus, and many others.

GENERAL SURGERY.

Removal of eutaneous tumors, as sebaeeous eysts, rodent uleers; excision of single ganglia about wrist and ankles, opening of abseesses, perineal, isehiorectal and others; tenotomies; operations on hydrocele, serous eyst of neek, traeheotomy, tapping of abdominal and thoraeie eavities; all these operations can be done and should be done under eocaine or beta-cueaine anesthesia.

When local anesthesia of the skin or deeper tissues is required, the cocaine or beta-eueaine solution must be injeeted hypodermieally into the deeper layers of the skin and into the eellular tissue of the parts to be operated upon. To avoid mul-

tiple punctures, the needle is not completely withdrawn from the wound, but its direction is changed and the solution is thrown into different portions of the tissues.

GENITO-URINARY SURGERY.

Use only 2% solution in the urethra. (a) To induce cocaine anesthesia of penile prepuce for circumcision: Retract prepuce, place constriction band around base of penis; inject by means of a fine hypodermic needle ten or twelve drops of 2% cocaine solution into the internal layer of the prepuce about one-half inch from its attachment to the glans penis; make blebs until cervix is completely encircled by them. Now draw prepuce forward, and at that point elected for incision make a similar line of blebs on the external preputial layer. (b) For enlarging meatus urinarius painlessly, to anesthetize area, place a tablet of cocaine just within the meatus and let it dissolve there. (c) Previous to cauterizing chancroids and ulcers of other nature, have the patient wash them thoroughly and then apply your cocaine solution vigorously; another method is to powder a few cocaine tablets and dust them on the ulcers; they will dissolve in the secretions and anesthetize the surface. (d) In the removal of vulvar, urethral and anal vegetations; in the cauterization and scarification of the uterine cervix; when it is

desired to cauterize vulvar vaginal mucous membrane in gonorrheal inflammations, cocaine is the anesthetic to resort to. Though curettage of the uterine cavity has been successfully performed under cocaine anesthesia, I prefer in that operation the aid of general anesthesia. (e) In internal urethrotomy inject a 1% solution in the urethra compress the meatus so that the solution will sojourn in the urethra.

In rectal surgery, when six injections are made equidistant around the anus, the forcible dilatation of the orifice is not painful. The ligation of small hemorrhoidal tumors can be performed under cocaine anesthesia; if the hemorrhoids are to be cauterized, the infiltration method of anesthesia is preferable to cocaine anesthesia, as incandescent heat destroys the drug. In anal work, the rich lymphatic and vascular supply of the part increases the liability to cocaine intoxication.

Cocaine anesthesia is of service as an aid to diagnosis: (a) To differentiate the glans penis pain from renal pain. (b) To examine the eyeball and conjunctival sac. Anesthesia of the eyeball abrogates that reflex movement of the lids. This is of value, in trying to locate a foreign body in the conjunctival sac or imbedded in the cornea, in blepharospasm, etc. (3) Applications of cocaine to the palate, to the uvula and to the posterior pharyngeal wall greatly facilitate, especially in

hypersensitive patients, laryngoscopical and posterior rhinoscopical examinations. It does this by abolishing reflex phenomena and by diminishing, or abolishing, temporarily, tactile hyper-sensibility. (4) In anterior and posterior rhinoscopy, by abolishing reflex excitability, by diminishing or abolishing dolorous sensibility, by contracting the vessels of the congested nasal mucous membrane, it facilitates the use of instruments in the nasal cavities. Cocaine, owing to its contractile effect on erectile tissues, enables the operator to examine the nares more closely. In nasal polypus, by diminishing the swelling around it, it makes the polypus more prominent. (5) For rectal examinations, especially when it is desired to palpate the prostatic gland, also in examining for anal fissure. (6) In sounding, and in examining the bladder by cystoscopy. In case of alarming symptoms appearing, rapidly empty the bladder and then wash it out. Very little absorption takes place from the vesical mucous membrane. However, it is unsafe to use cocaine solution in the bladder if any dissolution in the continuity of the lining membrane of the bladder is present. The anesthetization by cocaine of the urinary vesical mucous membrane having been attended in some cases by the production of alarming symptoms, many genito-urinary surgeons now use antipyrin to anesthetize the vesical mucous membrane. (7)

For the vaginal examination of highly nervous and hyperesthetic women, cocaine may be applied to the vaginal orifice.

COCAINE AS A THERAPEUTIC AGENT.

As a therapeutic agent, the anesthetic properties of cocaine are made use of: (a) To lessen the pain associated with superficial inflammation of the eyeball, especially those of the cornea. (b) To reduce the sensibility of a painful membranum tympani. (c) To lessen the pain incident to fissured nipples, it must always be washed off before putting child to the breast. Orthoform, being non-toxic, is for this purpose preferable to cocaine. Another objection to cocaine in this condition, is that it unfavorably influences the secretion of milk. (d) To combat dysphagia; in cases of pharyngeal stenosis produced by tumors, in pharyngeal or laryngeal phthisis and syphilis, in tonsillitis, in ulcers of the pharynx, epiglottis or larynx, the pain produced by swallowing is at times so severe that patients either refuse or are unable to take nourishment. By cocainizing the painful parts, the pain incident to the partaking of food in these conditions is mitigated or stopped. Patients can then take nourishment. This, the taking of nourishment, in all diseases, is an important adjuvant to medicinal measures. (e) To facilitate the introduction of the stomach-

tube when lavage or gavage of the stomach are indicated. Before introducing the stomach-tube paint vigorously the posterior buccal and pharyngeal mucous membrane with a 10% cocaine solution. This abolishes the sensitiveness of the parts and spares the patient the pain and nausea incident to this procedure, when anesthesia of the fauces has not been previously secured. If in the absence of cocainization, swallowing of the stomach-tube causes patient little or no discomfort, the use of cocaine is not indicated and should not be resorted to.

(f) In hyperemesis gravidarum, Lutaud recommends ten drops of 1% or 2% cocaine solution, repeated at one or two hours' intervals. In the gastric crises of tabes, the introduction into the stomach of five ounces of water containing from one-half to one grain of cocaine is most always followed by a palliation if not by a cessation of the pain. In stomatitis, in gastralgia, in boulimia, owing to its benumbing influence on the mucous membranes, it is a valuable palliative agent. (g) In catheterization of the Eustachian tubes through the nose, this procedure is greatly facilitated by previously applying cocaine to the nasal passage and to the pharyngeal orifice of tubes, by means of an atomizer, a brush, or with cotton on a probe. Under the influence of the cocaine, the mucous membrane becomes insensible, and then

the catheter glides over the parts without causing any pain, owing to the greater patulousness of the nasal passages. In most individuals, catheterization of the Eustachian tubes, introduction of the stomach tube, catheterization of urethra and examination of rectum can easily be performed without the aid of cocaine anesthesia. When the employment of a toxic agent is not required, its use should not be resorted to. (h) After operation for hemorrhoids, under general anesthesia, a cocaine suppository is comforting to the patient. In painful hemorrhoids, cocaine suppositories can be used with advantage. (i) In anal fissure, to obtain painless stools, so as to operate without general anesthesia (anal dilatation can be performed under cocaine anesthesia); in spasm of sphincter ani, to relieve anal itching of hemorrhoids; in all these conditions, cocaine, owing to its paralyzing action on the peripheral sensory nerve filaments, is of service. Use a tampon soaked in 5% solution and apply to fissure or insert in the rectum as indicated. (j) In vulvar and preputial pruritus, avail yourself of the action of cocaine on peripheral sensory nerve filaments. Also in eczema of the anus and of the genital organs.

(k) The employment of such agents as chromic acid, the galvanocautery, etc., etc., is by the use of cocaine made comparatively painless. "Cocaine solution applied for a few minutes to the surface

of an ulcer which is to be cauterized, will render the operation almost painless to the patient." (Wharton.) The efficacy of the destructive agent is not affected by cocaine. The ulcerated surface is to be swabbed vigorously with 10% solution. If the cauterization or curettage is to be deep, some of the cocaine must be injected in the tissues. (l) When a few drops of a solution of cocaine, 2% to 5%, are injected into the urethra, a catheter can be introduced without pain, provided there is no stricture. Be cautious as to its use here. Most of the cases of cocaine poisoning have followed its use about the urinary organs. (m) In vaginismus, the swabbing of the vaginal walls with a cocaine solution, then following this with a vaginal injection of a weak cocaine solution, though it will not cure the condition, will, however, suppress one of its annoying inconveniences. Coitus is made possible and painless to the woman. Conception is thus facilitated. In this condition, I have found the local use of the following mixture valuable:

Cocaine hydrochlorate.....	.30
Distilled water.....	20.00
Alcohol	10.00

(n) In localized neuritis, the cataphoric use of cocaine is valuable. Place the positive pole over the affected nerve; it is the sedative pole. You get

the analgesic action of the electricity and the analgesic action of the cocaine.

1. Observe the same aseptic and antiseptic precautions in operations done under local anesthesia that you do, or should do, in operations performed under general anesthesia. (a) Rigid surgical cleanliness of field of operation and irrigation with antiseptic solutions. (b) Thorough sterilization of all instruments and of all objects that are to come in contact with the field of operation. (c) Strict observance by surgeon and his assistants of modern surgical antiseptic teachings. Needle and syringe used should be aseptic. Needle can be boiled and a syringe full of alcohol passed through it previous to using.

2. Solutions used should be freshly prepared. Solutions of cocaine with age lose their anesthetic properties; they decompose and become septic; moulds form in them. Only distilled or filtered sterilized water or sterilized normal salt solution should be used for these solutions. The sterilization of solution by heat after the cocaine is dissolved in the water, decomposes the cocaine, moreover, it is superfluous, as unadulterated cocaine is sterile. If you keep on hand some cocaine solution, never load your syringe directly from the bottle. Sterilize a small glass, pour into it your cocaine solution (a quantity exceeding slightly in amount

that which you will need for the case at hand) and load your hypodermic from glass contents.

Non-sterile solutions give rise to suppuration in wound. The humors of the eye, the body juices are good culture media for germs.

3. The cocaine employed should be absolutely pure. Laborde has pointed out that its mixture with other alkaloids forms highly poisonous compounds.

4. According to Reclus, who has a record of 3,500 successful cocainizations, the dose should not exceed one-fifth grain for small operations, one to three grains in large operations. When the latter amount is used, great watchfulness must be exercised. The dose of cocaine should be appropriate to the extent of surface desired to render insensitive. A large dose should never be used at one time, but fragmented, given at intervals. The slow administration of cocaine rendering it possible to guard against the production of sudden symptoms of poisoning. Injections can be made as the operation progresses. Concentrated solutions should never be employed, the danger from their use is too great rapidity of absorption.

A weak solution permits a minimal amount of cocaine to reach a maximal extent of surface. The danger of cocaine anesthesia is proportional to the actual quantity of the alkaloid used and not to the amount of solution used. Reclus, when he

uses cocaine subcutaneously, confines himself to a 1% solution. With cocaine, when practical, it is well to make injections over the course of the sensory nerves in the part.

5. The use of a constricting band or tourniquet, when practicable, as in operations on extremities, as in circumcision, should never be omitted. In performing castration under cocaine anesthesia, surround base of scrotum with an elastic ligature. By the use of the constricting band or tourniquet the action of the drug is limited to desired area. Before applying tourniquet, elevate part to expel blood from same. The constrictor is applied at some point between the site of proposed operation and the trunk. It is drawn tighly enough to cut off the blood supply to the part. "When we shut off the blood from a portion of the body previously injected with a comparatively weak solution of hydrochlorate of cocaine, we maintain the latter for a protracted period of time in contact with the filaments of the sensory nerves; and are consequently enabled to prolong in the sensory filaments those chemical changes which are necessary for the suspension of their functional activity, for the maintenance of the condition of anesthesia." (Leonard Corning.)

This constriction prevents the rapid absorption of the drug into the general circulation and the dangers of intoxication incident to this rapid

absorption. Owing to lessened tendency to absorption, more latitude for the use of the drug is obtained. When this elastic ligature is removed, the bleeding from the stump washes out the excess of the drug. "The incision, the manipulation and the free bleeding which follows the removal of the constrictor should remove a considerable portion of cocaine." (Thompson.)

6. In some cases, the constricting band is useful, because it secures a wound unobscured by blood. Anemia facilitates the production of anesthesia. In operating on a limb, after the completion of the operation, the tourniquet is loosened for three or four seconds and then reapplied for several minutes; this procedure is repeated two or three times. In this way only a small quantity of cocaine is admitted into the circulation at one time and this small quantity distributed over a large area produces no ill results.

7. Extreme caution in the use of cocaine is to be employed, when the circulation cannot be controlled. First inject one centigram of the drug; if no untoward symptoms occur, there is no idiosyncrasy. You can then inject more.

8. Injections should always be practiced with patient in recumbent posture, and he should only be raised when the operation is to be performed upon the mouth or throat, and then only when the anesthesia is complete. (Magitot, Reclus.)

The recumbent posture is imperative in cocaine anesthesia. (Dujardin-Beaumetz.) Reclus insists upon the patient being kept in the recumbent posture, and adds that syncope in cocainization is the fault of the administrator and not of the cocaine. He makes patients keep recumbent posture for from two to three hours after the completion of the operation, and does not permit them to arise until they have eaten something.

9. When the operation involves the skin, the injection should be made into the derma itself and not into the subcutaneous cellular tissue. Anesthesia of the skin by cocaine is obtained only through endermatic injections. Cocaine cannot be absorbed through the unbroken skin. Hypodermatic injections secure subcutaneous anesthesia, but not cutaneous.

You will know that you are injecting the solution in the cutaneous tissues by experiencing the resistance which the dermal tissues offer to the advance of the hypodermic needle and by noting the formation of bleb-like swellings along the line of injection. Introduce the needle about parallel to the skin.

10. Do not inject the solution into a vein. Many of the accidents that have occurred under cocainization, and that have been attributed to idiosyncrasy, were, in reality, due to the injection of the drug directly into the veins. With proper precau-

tions, even in regions rich in veins, this should not occur. This is avoided by gradually expelling solution from the syringe at the same time that the needle is gradually withdrawn from the tissues.

Leonard Corning advises the following to avoid injecting cocaine solutions in veins: Pass a piece of ordinary elastic webbing around the central portion of the limb; draw it sufficiently tight to cause swelling of the superficial veins. It is now an easy matter to trace out the course of the distended vessels with an ordinary colored pencil, so that when the ligature is removed these topographical reminders remain upon the surface.

11. Expel the solution of cocaine from the syringe drop by drop, while the needle is passing through the tissues. The object of this is to control the largest possible field with a single injection; that is obtaining the maximal effect with the minimal dose. Make cocaine injections in an orderly manner. Inject the sub-epidermal tissues first and subsequently the deeper tissues. If the operation to be done requires deep dissection, injections must be both superficial and deep. Swab, if needed, field of operations with cocaine solution, every few minutes.

12. Let at least five minutes elapse after the first application or injection before applying the knife.

13. In inducing local anesthesia for the enu-

cleation of a small tumor located near the surface of body, inject solution beneath and around tumor so as to bathe neoplasm in the anesthetic fluid. Its dissection will then not be attended with any suffering.

When giving cocaine, always have some aromatic spirits of ammonia, some nitrite of amyl and some ether at hand. These are useful agents with which to combat cocaine intoxication. Upon the first appearance of symptoms of poisoning, have (a) patient immediately assume the recumbent posture. Recovery takes place more rapidly in this posture. (b) Give hypodermic injections of ether.

ACCIDENTS AND THEIR REMEDIES.

Accidents are often due to the faulty technique of the physician, such as the use of an overdose, failure to have patient maintain the recumbent posture, non-employment of means that prevent too rapid absorption, as the constricting band or tourniquet, the use of an adulterated product, etc. Among the symptoms of poisoning may be mentioned loquacity, cold perspiration, shallow respirations, rapid, feeble pulse, unconsciousness and convulsions. Cocaine can cause death by causing paralysis of the respiratory center or tetanic fixation of respiratory muscles.

In paralysis of respiratory center:

a. Elevate trunk and lower head.

b. Practise artificial respiration.

c. Give strychninæ sulph. gr. 1-20 hypodermically. It is the best respiratory stimulant that we have.

d. Give amyl nitrite, or hypodermics of nitroglycerine.

In tetanic fixation of respiratory muscles give:

a. Inhalations of amyl nitrite.

b. Chloral and bromide in the form of enemata.

c. Morphine sulph.

Morphine, though not an absolute antidote, is most valuable in counteracting the toxicity of cocaine. "There exists a marked antagonism between cocaine and morphine, also between cocaine and chloroform or ether." (Willard and Adler.)

In all forms of cocaine poisoning, empty the bladder and activate urinary secretion. Meet sleeplessness by hypnotics or narcotics. In delirium due to cocaine intoxication, if the heart be not very weak, chloral can be used or hyoscine hypodermatically. If patient be very delirious, he will have to be restrained.

Infiltration Anesthesia.

The technique of this method was first elaborated and introduced to the medical world by Dr. C. L. Schleich of Berlin. It is based upon the fact that endermatic injections or infiltration of the various tissues of the body with water, or

watery solutions of indifferent substances will produce local anesthesia of the tissues infiltrated. Previous to the introduction of Schleich's infiltration method of local anesthesia, deep injections of cold water along the course of the sciatic nerve were made with alleged benefit. If the production of the anesthesia is preceded by the production of pain, we have the condition which is called anesthesia dolorosa. (Liebrich.) ".02 parts to 100 parts of distilled water is the weakest cocaine solution which can produce local anesthesia without prodromal hyperesthesia." (Schleich.)

Infiltration causes anesthesia by

a. Causing an anemia of the part. This anemia is due to the compressing action exerted by the injected fluid on the bloodvessels.

b. Low temperature of the injected solution. Its temperature must always be lower than that of the body. If both are of the same temperature, the anesthetic effect is greatly diminished; whereas if the solution is ice-cold, anesthetic action is augmented.

c. The mechanical pressure exerted on tissues, notably on nerve filaments.

d. Direct specific but not destructive effect of injected solution on the nerves.

e. Destructive chemical action on the nerves.

f. The maintenance of complete edema of the tissues to be operated on.

The anesthesia produced by this method is instantaneous. As soon as the tissues have been edematized, they are anesthetic. This differs from other methods of local anesthesia, and is a distinct advantage. "Every tissue is anesthetic that can be artificially edematized by our solutions." (Schleich.) This holds good for skin and mucous membrane, periosteum, synovial membrane, fascia, muscle, lymph, glands, nerves, viscera, and even bone.

The infiltration method of anesthesia is unsuited for use.

a. In most abdominal and pelvic operations.

b. In ophthalmic surgery, as relating to the eyeball. Cocaine is the ophthalmologist's most serviceable anesthetic.

c. In nasal, naso-pharyngeal and intra-laryngeal manipulations and surgery. Dr. Coulter, however, uses infiltration anesthesia when performing tonsillectomy. (Removal of all the tonsillar tissue through mouth by means of the galvano-cautery.

d. In plastic surgery, the artificial edema which is the basis of the modus operandi of "the infiltration method" interferes with the nicety of surgical operations. Infiltration produces an extensive artificial edema which masks anatomical details considerably, thus rendering the operation more difficult. Infiltration by distorting the flaps increases the difficulties of the operation.

e. In skin grafting operations. Infiltration impairs the vitality of the flaps. (Lieberthal.)

f. Whenever the limits of the disease are not readily definable as in malignant tumors. The presence of much fluid in the tissues changes their appearance and renders difficult the demarcation of sound from diseased tissues.

g. In diffuse cellulitis, requiring free incisions.

h. In cases of malignant new growths, of diffuse tuberculosis, etc. The increased hyper tension of part makes possible the forcing of the materies morbi into the lymph channels. "In the removal of large neoplasms or large purulent collections the infiltration method is not suitable." (Braun, Leipzig.) There is danger that the repeated needle punctures may disseminate an already existing infectious material into previously healthy parts.

i. In all cases where local anesthesia is contra-indicated as in very nervous patients who dread watching the surgeon's manipulations.

j. In children.

With this method, anesthesia occurs at the moment of completion of artificial edema and not before. It lasts from 10 to 15 minutes and can be prolonged by further addition of the fluid. No part is to be operated on before the artificial edema is complete.

The quantity of toxic agents present in the

solutions employed is so small that the use of comparatively large quantities of the solutions is attended with no risks of drug-poisoning. Different solutions have been used. Arthur E. Barker (London) uses the following, worked out by Braun. He says that it can be used practically in any amount without danger of producing poisonous effects.

BRAUN'S (LEIPZIG) FORMULA.

Beta-Eucaine	1 part by weight.
Chloride of sodium.....8	" " "
Water 1000	" " "

The advantages of beta-eucaine over cocaine are that it is far less toxic and that it admits of thorough sterilization by boiling.

In Braun's formula, beta-eucaine is the only anesthetic used in the solution, the salt simply preventing irritation. Prof. Schleich has used beta-eucaine in his operative work. He has observed its non-toxic properties. He says that it can be substituted for cocaine in his method of infiltration anesthesia. Owing to the absence of vaso-constrictive effects, beta-eucaine does not allow of so bloodless an operation as is the case with similar doses of cocaine dissolved in normal salt solution.

There can be no doubt that cocaine and beta-eucaine are simple substances to be considered in the selection of a drug for infiltration anesthesia;

they paralyze without irritation, and without injury to the tissues; and they effect an anesthesia lasting enough for practical purposes even in extreme dilution.

Most operators, however, use Schleich's formulas. They are the following:

SCHLEICH'S FORMULAS.

No. 1. Strong—for operations on highly hyperesthetic areas. Inflammation, suppuration, neuralgia. The more sensitive the parts are that you operate on, the greater must be the concentration of the cocaine.

Cocaine hydrochlor.....	.2
Morphine hydrochlor.....	.025
Sodium chloride (ster.).....	.225
Distilled water (ster.).....100.	
M. et adde 5% acid carbol. gtt..	2.

One ounce of this solution contains about one grain of cocaine.

No. 2. Normal—for operations on moderately hyperesthetic areas.

Cocaine hydrochl.....	0.100
Morphine hydrochl.....	.025
Sodium chl. (ster.).....	.2
Distilled water (ster.).....100.	
M. et adde 5% acid carbol. gtt...	2.

One ounce of this solution contains about one-half grain of cocaine.

No. 3. Weak—the weakest possible solution for

extensive operations to be used alternately with stronger solutions:

Cocaine hydrochlor.....	.01
Morphine hydrochlor.....	.005
Sodium chloride (ster.).....	.2
Distilled water (ster.).....	100.
M. et adde 5% acid carbol. gtt...	2.

These solutions must be kept absolutely sterile.

These ingredients can easily be prescribed in the form of a powder to be dissolved in sterilized water just previous to using. Every practitioner should always have in his satchel a few of these powders, kept in a sterilized flask.

Only sterilized water must be used in the preparation of the solutions. The sodium chloride is roasted in a small pan. It may be sterilized by boiling in a small amount of water in a well-cleansed test-tube and then allowing it to cool. It is added to the solutions to attenuate the irritating action of the water. The one-fifth per cent solution of sodium chloride is a practical anesthetic when the skin is healthy. It will not suppress pain in hyperesthetic inflamed areas. (Schleich.) Inflamed tissues are highly sensitive. To do this, cocaine is added to the solution.

Morphine does not need to be sterilized. Like cocaine in the pure state, it is bacteriologically sterile. Heat decomposes these alkaloids. They should be weighed on a well-cleansed scale. Mor-

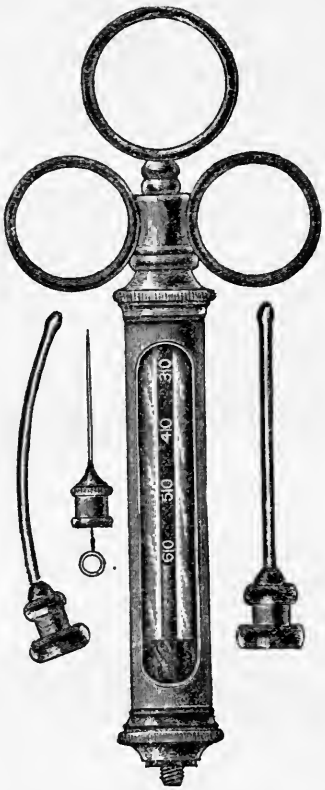

Fig. 1.

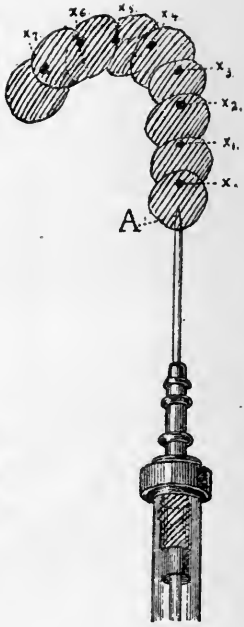

Fig. 2.

FIG. 1.—Bransford Lewis Infiltration Syringe.

FIG. 2.—Formation of the cutaneous wheals. A spot made anesthetic by ether spray for the first injection.

phine was incorporated in Schleich's solutions for the purpose of allaying the paresthesia incident to the wearing off of the anesthesia. As stated, Schleich's solutions are prepared with boiled and filtered water, and if the hands and instruments used in its preparation are sterile it may be regarded as aseptic. It is, however, not antiseptic, and if accidentally contaminated is unfit for use.

An ordinary hypodermic needle may be made to serve for injecting the solution in many cases. It is better, however, to have a larger syringe with several needles, some straight, some curved. "The Bransford Lewis Infiltration Syringe" is very serviceable. The barrel of the syringe is large, the needles have a rounded end, or probe point, which prevents their piercing such structures as veins, arteries or nerves.

Such operations as enucleation of buboes, circumcisions, castration, colotomy, cholecystotomy, drainage of empyema of thorax, have been successfully performed under infiltration anesthesia. August McLean says "The infiltration does not appear to have any deleterious effect upon the healing of the tissues." In many of his cases, there was primary union.

In 3,500 cases, Schleich did not once convey infection by means of the injected fluid.

In beginning to use the infiltration method, select easy cases, such as ablation of small tumors,

suture of wounds. As your experience with the method increases, you can use it in more difficult cases. Experience will perfect your technique. Each case teaches something which will perhaps be useful in the next.

TECHNIQUE OF METHOD.

1. Scrub, shave, and otherwise prepare field of operation.

2. Observe, and have your assistants observe, modern antiseptic teachings.

3. Needle, syringe and anesthetic solution must be sterile. Syringe must be in good working order. It is very annoying to have a leaking syringe.

4. Place the bottle containing the solution on ice. It must be kept on ice during the entire duration of the operation. The anesthetic properties of the solutions are intensified by cold. Warm solutions are unfit for anesthetic use. The syringe should also be cooled.

5. To make the first puncture, by needle, painless, a spray of chloride of ethyl can be directed against the skin; a pledget of cotton dipped in cocaine solution placed upon the mucous membrane.

6. Insert needle in skin, holding the syringe at an angle of 45° to the skin. Inject sufficient of solution to produce a wheal about the size of a dime. Remove needle, reintroduce at the periphery

but still within the wheal, inject enough of solution to form a new wheal and repeat this process as often as indicated. In this way the line of incision is anesthetized. When solution is thrown into skin, the end organs of the sensory nerves situated there immediately absorb the solution and are temporarily paralyzed. (Barker, London.) Anesthetize skin broadly, so that the suture line will be infiltrated.

Now an incision can be made through the skin, and infiltration of the deeper tissues proceeded with, or the subcutaneous tissues can be squeezed full of fluid through the anesthetized skin. The important fact being that all tissues that come within the field of operation must be edematized to be anesthetic. Spots which have not been infiltrated retain their sensibility. If the tissues to be operated on are not very deep, it is better to infiltrate through the skin. Infiltration in the open wound is more difficult, as the fluid escapes. Do not infiltrate through the skin deeper than the superficial muscles except in cases where the tissues to be anesthetized are superficially located, as over the skull, over the clavicle, over the sternum. When tissues are dense, considerable pressure is necessary to infiltrate them.

7. The field of operation must be tensely filled with the solution before beginning to operate. If, during operation a large nerve trunk is met, it may

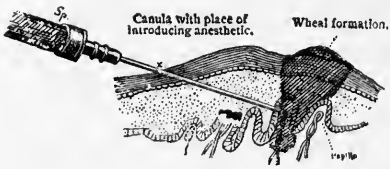

Fig. 3.

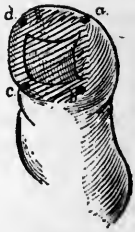

Fig. 4.

FIG. 3.—Diagram of a section of the skin, showing formation of the first wheal.

FIG. 4.—Infiltration of ingrowing toe-nail.

Fig. 5.

Fig. 6.

FIG. 5.—1, Furuncle; 2, Anesthetized skin; 3, Infiltration of subjacent tissue; 4 and 5, First and second position of syringe.

FIG. 6.—Infiltration of abscess.

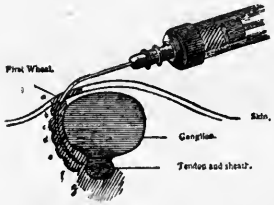

Fig. 7.

Fig. 8.

FIG. 7.—Tumors.

FIG. 8.—Infiltration around finger going down to periosteum.

be anesthetized, for a short time only, by touching it with a 5% carbolic acid solution. If nerve is to be cut, it must be infiltrated separately. If patient during operation complains of the slightest pain, the part must immediately be reinfiltrated.

Pain is a sign of insufficient anesthesia, insufficient edematization. As soon as infiltration is complete, pain is absent. "Tissues not thoroughly infiltrated must not be cut or manipulated." (Lund.) The surgeon must lay down the knife and take up the syringe on the slightest expression of pain on the part of the patient. Should it become necessary to extend the field of operation beyond the infiltrated area, injections must be made in the direction required, starting from within the anesthetic area.

8. Never begin the infiltration in inflamed area. Surround it and advance upon it from all sides, via sound skin. Inflamed tissues, owing to their hypersensitiveness, are not to be infiltrated until the adjacent normal tissues are infiltrated. Primary injection into an abscess, phegmon or pathological focus is to be avoided as it increases the tension and does not lessen the pain.

9. Do not inject contents of syringe in a blood vessel. If operation has lasted more than fifteen or twenty minutes, it will be necessary to anesthetize points of entrance and of exit of suture before closing the wound.

Spray is applied to one side of furuncle and the first wheal is set up within healthy skin. Push a long needle in an oblique direction through skin, expelling the solution all the time as you advance and deposit an anesthetic focus beneath the furuncle. (Fig. 5.)

Repeat this process on opposite side of boil. Use solution freely. Once the furuncle is completely cut off from the surrounding tissues by an anesthetic zone, anesthetize the skin covering it, beginning within the infiltrated area and advancing towards it. Now incise and evacuate and curette the furuncle.

For removal of sebaceous cyst, or small tumor, cut skin along line of wheals, severing only the skin. Adapt now a curved needle to syringe. Raising by aid of forceps the cut edge of the skin, insert needle gently and gradually, push it around underneath the cyst, steadily expelling solution from syringe all this while. The tissue beneath the cyst is thus anesthetized. Now draw out needle, and repeat the same injecting procedure on the other side, always expelling fluid from syringe as needle advances. The cyst is thus wholly enveloped by edematious and anesthetized tissue.

Abscess. Never inject solution in abscess. It increases pressure on all sides. It intensifies the pain. Begin at one side in healthy skin and proceeding towards abscess anesthetize by the forma-

tion of intracutaneous wheals, the skin overlying the abscess. (Fig. 6.) The skin being infiltrated, infiltrate subjacent and surrounding tissues.

The accompanying illustrations portray the technique better than words.

For amputations or in operations upon bone, the periosteum must be infiltrated in its whole circumference. When this has been done, bone may be divided by saw or forceps without unbearable pain being caused. The medulla of bone can be infiltrated through an opening made in cortex of the bone.

HOLOCAINE, NIRVANINE, ORTHOFORM.

The popularity of these agents is increasing. Laboratory experiments show that when properly employed they are of value as local anesthetic agents. Their toxicity, holocaine excepted, is less than that of cocaine. They have a sphere of usefulness the exact extent of which is yet to be determined. It can only be determined by actual clinical use. The objection to them can be raised, as it can with all other local anesthetic agents, that the anesthesia which they produce is not as complete as that secured by general anesthetics. To employ them to good advantage one must know their possibilities and also their limitations. As with many other valuable drugs, when given in

doses in exeess of the therapeutic dose, they are liable to eause annoying aeeidents.

HOLOCAINE.

"Holoeaine is the ideal loeal anesthetie for removing foreign bodies from the conjunctival sae." (Knapp.) "Holoeaine is freely soluble in boiling water, but sparingly in eold water. It is neutral in reaction. Having germieidal properties, solutions of holoeaine do not need sterilization. Boiling does not ehange it ehemieally or reduee its efficaey, but as a 1% solution is deeidedly baeterieidal, sterilization by heat is unneeessary." (Louis C. Dean.) In making solutions of holoeaine, dissolve the latter in a poreelain vessel, as it eauses glass containing alkali to lose a portion of the latter. This elouds the solution. Holoeaine is a stable agent. A 1% solution will remain elear for about two months.

Applied to mucous membrane, it produces no constitutional symptoms. Administered subeutaneously, it is a poison. No poisonous effect from the local use of the drug has ever been reported. The toxie dose of holoeaine when administered subeutaneously or internally, is one eentigramme. Holeaine is used extensively in ophthalmie praetiee. It has been found to be an efficient loeal anesthetie in eye surgery. It seems to aet by produeing a paralysis of the sensory nerve endings.

Unlike many other local anesthetic agents, it causes neither ischemia nor freezing of the part. Outside of rendering the eye anesthetic, holocaine has no other effect upon it. It produces anesthesia of the eye without producing any other associated symptom. It acts in the same manner in contact with the hyperemic or granular conjunctiva as in the presence of a normal conjunctiva. It causes hyperemia of the conjunctival blood vessels.

Anesthesia is rapidly induced, that is, in from one to two minutes. From this standpoint, in comparison with cocaine, a considerable saving of time is effected. "One or two drops of a 1% solution generally brought about entire anesthesia in from forty to fifty seconds; when a second application was made, forty seconds after the first, entire loss of sensation invariably followed in thirty seconds more." (Hasket Derby.)

"As holocaine is five times more toxic than cocaine, and the effect of a 1% solution of holocaine is about equal to 5% solution of cocaine, there would seem to be no greater danger from the use of one than from the other." (Deane.)

The 1% and 2% solutions are the solutions most commonly used; a few drops of either of these solutions instilled in the conjunctival sac will secure an anesthesia of that membrane and of the superficial structures of the eye in from one to three minutes. This anesthesia lasts about ten

minutes. Two or three instillations at one minute intervals may be required. Immediately after instillation, a slight burning, smarting sensation is experienced. This is not lasting; it rapidly passes off.

The advantages which holocaine possesses for ophthalmic use are:

(a) Rapidity, promptitude of action.

(b) Does not dilate the pupil.

(c) It does not affect the accommodation. No unpleasant blurring of vision follows its use.

(d) It does not increase the intraocular pressure.

(e) It does not impair the integrity of the corneal epithelium. Holocaine not contracting the conjunctival blood vessels, it causes neither bleaching of the eye, nor lessening of the lachrymal secretion, nor drying of the corneal epithelium.

(f) There are no after effects. In cutting operations, the increased hemorrhage due to the hyperemia which this agent occasions is of service to wash out pathogenic germs that may be present on the corneal or conjunctival wound.

"When the surgeon of to-day has cut his finger with a knife passed through tissues of doubtful purity, he no longer burns out the wound but makes it bleed." (Knapp.)

(g) Stability and bactericidal quality of solutions. Infection under the use of holocaine is not

possible when a proper antiseptic technique is observed. Because the solutions are bactericidal. The hemorrhage occurring under holocaine anesthesia is regarded by many ophthalmologists, Dr. Knapp among others, as lessening the danger of infection. The hemorrhage has a tendency to wash out the bacteria present in the wound.

"A 1% solution stops fermentation and putrifaction entirely." (Heinz.)

It is useless to add any antiseptics to solutions of holocaine with the view of keeping them antiseptic. "Germs can not live in solutions of holocaine, for it actually kills these organisms." (R. L. Randolph.)

(h) It may be used when cocaine is contraindicated, as in glaucoma. In the performance of iridectomy in glaucoma, it has been found to be of special value. "In glaucoma, dilation of the pupil increases and contraction diminishes intra-ocular pressure. This long ago led to the observation that the instillation of atropine, cocaine and other drugs that dilate the pupil might produce an attack of glaucoma in an eye predisposed to this disease." (Derby.)

In ulcer of the cornea and in all operations upon the cornea it is to be preferred to cocaine, as it relieves pain equally well and it does not impair the integrity of the corneal epithelium. It has

no dessicating action on the cornea. "Holocaine does not interfere with nutrition of tissue, but rather increases the blood supply and hastens healing." (Wurdemann and Black.)

The vaso-constrictor action of cocaine is useful in operations on vascular tissue, but is harmful in those performed upon the cornea because of the unfavorable way in which it influences nutrition.

Holocaine, owing to its poisonous nature, should never be used subcutaneously. Even in minute doses, when administered internally, it is highly poisonous. (The poisonous nature and the mineral toxic dose of holocaine have been determined by laboratory experiments. There are no reports of fatalities occurring in man from the use of holocaine.) Symptoms of intoxication due to the internal use of holocaine simulate those observed in strychnine poisoning. You will treat this condition symptomatically. As holocaine does not contract the blood vessels, operations under its influence are likely to be attended by more homorrhage than those performed under cocaine. In muscle operations, in pterygia and deeper operations upon the globe of the eye, the tendency to more free hemorrhage is disadvantageous. Hemorrhage obscures the field of operation; it also seems to lessen the duration of the anesthesia. This is probably due to washing out of the anesthetic by the outflow of blood.

NIRVANINE.

Nirvanine is a local anesthetic agent, only one-tenth as toxic as cocaine. It has been used in children without ill effects. Its use is not attended by any excitement, influence on respiration, or weakening of the heart's action. Owing to the relative nontoxicity of this drug, it is of special value to secure anesthesia of parts, the circulation of which can not be easily controlled, as in operations in anal regions. Nirvanine anesthesia lasts longer than cocaine anesthesia.

For the ophthalmic surgeon, nirvanine is not a serviceable anesthetic. Applied to the unbroken skin it does not anesthetize it. Applied to the mucous membrane it is not to be recommended when it is intended that anesthesia should reach deeply as in nose and throat surgery.

The field of nirvanine is in subcutaneous and in infiltration anesthesia. When you wish to employ subcutaneous, or submucous nirvanine anesthesia, you can secure it by employing the same technique that is employed in securing cocaine endermic and hypodermic anesthesia. For nirvanine infiltration anesthesia make use of the technique that is employed for securing infiltration anesthesia with Schleich's formulæ. There is this difference, however, that when you use the Schleich's formulæ anesthesia is complete as soon as the tissues are completely infiltrated, while with the nirvanine

solutions from five to eight minutes elapse before anesthesia sets in.

Nirvanine is being increasingly used by the dental profession. For tooth extraction, inject your solution of nirvanine on either side of the tooth down to the periosteum. Place the fingers over the punctures to prevent the solution from running out and then by gentle pressure assist in dispersing the liquid into the surrounding tissues. Wait three to five minutes before extracting the tooth.

Sterilization by boiling does not decompose nirvanine solutions and does not impair their anesthetic properties. For hypodermic injection anesthesia, the most commonly used solutions are the 1%, 2%, 3% and 5% aqueous solutions. For infiltration anesthesia, a $\frac{1}{4}$% to $\frac{1}{2}$% solution is used. Luxemburger recommends that nirvanine be dissolved in normal salt solution.

ORTHOFORM.

Orthoform is a tasteless, odorless, whitish powder. It is but slightly soluble in water; it is very soluble in alcohol and ether. This insolubility in water unfits it for hypodermic use and for infiltration anesthesia. It is sterile, but is not bactericidal to the germs of suppuration. No germs are found in it as it leaves the factory, and the few germs that may accidentally gain access to

it by careless exposure or by unclean contact are either destroyed or lose much of their virulency. In cases in which an antiseptic as well as an anesthetic action is desirable or required, orthoform can be combined with any of the following antiseptic agents: Iodoform, dermatol, aristol, zinc oxide, calomel. The first four agents must be sterilized before they can be used on wound surfaces. The afore-mentioned agents are not chemically, pharmaceutically nor physiologically incompatibles of orthoform.

The drug when used in therapeutic doses is non-toxic. It has in a few reported instances, when applied too profusely, caused an eczematous condition of the skin surrounding the wound with which it had been in too prolonged contact. This accident I have never met with. Should eczema occur after its use, stop using the preparation for two or three days. If on second trial eczematous lesions are again provoked, the drug is not suited for use in that individual case. The drug has been given internally in doses of from 15 to 25 grains daily without inflicting any injury upon the organism.

Orthoform does not act upon the unbroken skin. "The substance will not act on unbroken skin nor with certain reservations on intact mucous membrane." (Young.) On the unbroken mucous membrane of the mouth, naso-pharynx and larynx,

orthoform does not secure anesthesia suitable for surgical action. To produce anesthesia, it must come in contact with terminal sensory nerve-endings. It then produces in from three to eight minutes anesthesia of the surface to which it has been applied. This anesthesia is complete to pain only.

Orthoform is chiefly used to secure absence of pain in painful non-operative conditions and after operations in hyperesthetic areas. Its anesthetic action is prolonged for hours. We can use orthoform, either pure or diluted, as a dusting power applied to the open surface which we wish to anesthetize. It can be used in alcoholic solution; an ointment of from 10 to 20 per cent with lanolin base; in emulsion with the yolk of egg; in 10 per cent solution with collodion.

INDICATIONS FOR USE.

1. To relieve the pain of ulcers, chancroidal, syphilitic, tubercular, carcinomatous or simple chronic ulcers. Apply the drug to the surface of the ulcer and insure its retention there. Orthoform coming in contact with the exposed nerve endings secures a marked and often a complete suppression of the pain. It does not interfere with the regeneration of tissues and exerts no unfavorable influence on the economy. It secures a long anesthesia. If exudation is abundant, use it in the form of an ointment. An abundant exudate

washes off the powder. Owing to the innocuousness of orthoform, repeated applications are not harmful. In rectal chancroids, in rectal carcinoma, a 10 per cent orthoform suppository will do away with the pain, and will enable the patient to dispense with the use of opium, with its allied constipating effects and antagonism to assimilation. Non-toxicity of orthoform is demonstrated by the fact that in a case of inoperable carcinoma two ounces were applied weekly without any ill effects. As a local application to corneal ulcers, to canker sores, and to herpetic ulcers, it is very satisfactory. It may be used in carcinoma of the tongue to make eating painless. Dusting orthoform upon painful, indolent, varicose ulcers renders them comparatively painless. Avoid eczema by not using orthoform too freely in the beginning and by the application of a thick zinc-oxide ointment around the ulcer.

2. To relieve the soreness and pain resulting from cutting, snaring or cauterizing operations upon the nasal cavity. Powder can be applied to the field of operation, or orthoform gauze can be packed lightly into the cavity. Orthoform gauze can be packed in wound sinuses.

3. In tubercular laryngeal ulcerations, orthoform is of value to relieve pain and to cause a disappearance of the difficulty of swallowing. In the larynx, orthoform is best applied with an insuf-

flator. Use about five grains at each insufflation. It enables tuberculous patients to take nourishment, thereby retarding the progress of the disease. The following emulsion is recommended in laryngeal ulcers by Freudenthal:

Menthol	10.
Ol. amygdalae dulc.	30.
Vitelli ovi. about two yolks	30.
Orthoform	12.5
Aq. dest. q. s. ad	100.

M. et. ft. emulsio.

In using this emulsion in the larynx, use an ordinary laryngeal syringe.

4. As an application for burns, be they thermic or chemical, when there is an exposure of nerve terminals. It secures an almost immediate cessation of pain. This anesthesia lasts about twelve hours. "Almost immediately after its applications for burns, even if they be deep, the pain ceases." (Maygrier.)

5. As an application to operation wounds. To lessen the after pains of an operation. After the removal of the faucial tonsils if orthoform be applied to the cut surfaces, the patient can eat solid food without pain being excited. After circumcision, after cauterization, after operation for hemorrhoids, etc., the local use of orthoform is palliative. For the relief of severe pain following the application of the various caustics or the actual cautery, orthoform powder or ointment applied to

the raw surface and covered with the gauze dressing is efficacious.

6. Upon excoriations as in those that are present around artificial ani, as an application for bedsores, etc.

7. Upon lacerated wounds. I have used it frequently in crushing wounds of the finger. Painful sinuses can be tamponed with orthoform gauze, it can be used upon painful perineal and vulvar lacerations following delivery.

8. In painful hemorrhoids, the application of a 10 per cent ointment about ten or fifteen minutes before going to stool makes the latter painless. In cases of anal fissure and other painful lesions of anus and rectum, its use is serviceable.

9. Upon the exposed pulp of carious teeth; after teeth extractions. For dental caries introduce into the dental cavity, previously dried, a plug of cotton impregnated with the following preparation:

R. Orthoform .....gr. 15
Acid. carbolici .....gr. 15
Camphorae,
Chloral hydrate, aa .....gr. 40

10. In painful fissured nipples. Apply to the nipple, ten minutes previous to putting the child to the breast, a pledget of gauze impregnated with a saturated solution of orthoform. After several applications, nursing will in most cases cease to

be painful. You get the anesthetic action of the orthoform and you also get the antiseptic action of the alcohol. Maygrier used this treatment in forty cases of fissured nipples; in all he secured complete analgesia of the breast while at rest. Pain during nursing was in all cases markedly diminished. In the majority of the cases it had disappeared entirely.

INDEX.

Abdominal Operations, 27.
Accidents of Anesthesia, 87.
Adenoids, 28.
Age, Selection of Anesthetics for, 20.
Alcoholism, Anesthetic in, 25.
Allis Inhaler, 82.
Anesthesia, General, 7.
— in Convulsions, 13.
— duration of, 54.
— incomplete, 59.
— infiltration, 155.
— local, 112.
— precautions in, 43.
Anesthetics, "Crowding," 48.
— Diagnostic, Uses, 11.
— in Obstetrics, 13.
— Rules for Administration, 35.
— Therapeutic Uses, 12.
— Selection of, 18.
— Time of Administration, 38.
— in Surgery, 17.
Anesthetist, Attention to Duty, 49.
— Cleanliness of, 36.
— Position of, 38.
— Outfit of, 35.
Antipyrin, 119.
Asphyxia, 88.

Beta-Eucaine, 113.
Blood, Color of, 60.
Braun's Formula, 159.
Breathing, Encouraging, 56.
Bromide of Ethyl, 97.
Brucine, 113.

Carbolic Acid, 118.
Childbirth, Anesthetics in, 14.
— Chloroform in, 14.
Chloroform, Points Concerning, 77.
— Purity of, 36.
Circulation during Anesthesia, 66.
Circumcision by Local Anesthetic, 117.
Climate and Anesthetics, 21.
Cocaine, 130.
— Accidents with, 154.
— as an Aid to Diagnosis, 143.
— in Genito-Urinary Surgery, 141.
— Method of Using, 149.
— in Mouth and Nose, 137.
— in Ophthalmology, 134.

— in Otology, 139.
— properties of, 131.
— as a Therapeutic Agent, 144.

Danger, Signs of with Chloroform, 81.
Diabetes Millitus, Proper Anesthetic, 24.
Dress, 44.

Eclampsia, Chloroform in, 16.
Environment and Anesthetic, 21.
Esmarch Inhaler, 80.
Ether Accidents, 88.
— Administration of, 83.
— Pneumonia, 85.
— Points Concerning, 82.
— Purity of, 36.
— Time Required, 84.
Ethyl Bromide, 97.
— Bromide, Advantages of, 100.
— Bromide, Disadvantages, 102.
— Bromide, Technique of, 104.
— Chloride, 129.
Eucaine, 113.

Face, Care of, 44, 45.
Guaiacol, 118.
Goitre, Chloroform in, 25.

Head, Position of, 53.
Headache after Anesthesia, 95.
Heart's Action, 66,
Holocaine, 169.
Hydrocule, Local Anesthesia, 118.

Inhaler, Allis, 82.
— Esmarch, 80.
Infiltration Anesthesia, 155.

Labor, Chloroform in, 13.
Liver Impairment, 25.
Local Anesthesia, 112.
—— Advantage of, 120.
—— Contra-indicated, 124.
— Anesthetics, 113.
—— Choice of, 15.

Morphine in Anesthesia, 49.
Mortality from Anesthetics, 19.
Muscular System, 68.

Neck, Operations in, 28.
Nirvanine, 175.
Nervous System, 79.
Nitrous Oxide, 28.

Obstetrics, Anesthetics in, 13.
Operation, Nature of, 26.
Ophthalmology, Chloroform in, 26.
Orthoform, 176.

Paralysis, Post - Anesthetic, 95.

Patient, Age of, 20.
— Care of During Operation, 44, 45, 50, 51.
—Physical Condition of, 22.
— Posture of, 30.
— Preparation of, 31.
— Respiration of, 56, 61.
Phthisis, Proper Anesthetic, 24.
Pneumonia from Ether, 85.
Position, Change of, 51.
— of Head, 53.
Post - Anesthetic Treatment, 86.
Posture of Patient, 30, 39.
Preparation of Patient, 31.
Pulse during Anesthesia, 66.
Pupil, Observation of, 74.

Rectal Surgery, 29.
Reflexes during Anesthesia, 64, 72.
Refrigeration, 119, 127.
Respiration, Artificial, 90.
Respiratory Diseases, Anesthetic in, 24.
Room Used, 52.

Schleich's Formulas, 160.
Struggling, 55.
Strychnin and Stimulants, 77.
Syncope, 89.
— Measures to Combat, 91.

Teeth, Extraction of, 28.
Tongue, Care of, 54, 58.
Tracheotomy, 26.

Vomiting after Anesthesia, 93.
— during Anesthesia, 57.

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